ABR 3000 Series Barcode Reader

Instruction Manual

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1 Product Description

Imager-based barcode reader with superior decoding capability in a compact housing



- Powerful decoding capability to read even difficult 1D and 2D codes
- Ultra-compact metal housing for industrial environments
- Quick configuration with push buttons or software interface
- Available in multiple resolutions and with USB or Ethernet communications
- Integrated LED lighting and easy focus adjustment in one package for maximum application flexibility
- Green "good-read" feedback spotlight and beeper for easy monitoring
- Embedded webserver interface for monitoring images and statistics over any network

WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

1.1 Models

Table 1: ABR 3000 Models

Model	Resolution	Lens	Lighting	Options	Communications	Codes
ABR3009-WSU2	WVGA (752 × 480 pixels)	9 mm, manual focus	White	Standard	Serial/USB	1D and 2D
ABR3009-WSE2					Serial/Ethernet	1D and 2D
ABR3009-WSU1					Serial/USB	1D
ABR3009-WSE1					Serial/Ethernet	1D
ABR3106-WSU2	1.2 MP (1280 × 960 pixels)	6 mm, manual focus			Serial/USB	1D and 2D
ABR3106-WSE2					Serial/Ethernet	1D and 2D
ABR3106-WSU1					Serial/USB	1D
ABR3106-WSE1					Serial/Ethernet	1D
ABR3106-WPU2				Polarized	Serial/USB	1D and 2D
ABR3106-WPE2					Serial/Ethernet	1D and 2D

1.2 Laser Description and Safety Information

All ABR 3000 contain one aiming laser source used to position the reader. Disconnect the power supply when opening the device during maintenance or installation to avoid exposure to hazardous laser light. The laser beam can be switched on or off through a software command.

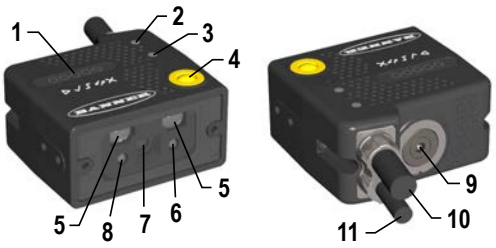
These products conform to the applicable requirements of IEC 60825-1 and comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice N° 50, date June 24, 2007. This product is classified as a Class 1 M laser product according to IEC 60825-1 regulations.

CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. Do not attempt to disassemble this sensor for repair. A defective unit must be returned to the manufacturer.

Class 1 lasers are lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

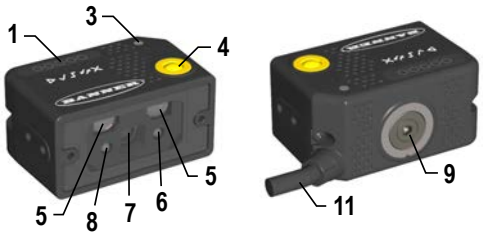
1.3 Features

Figure 1. Models with Serial and Ethernet



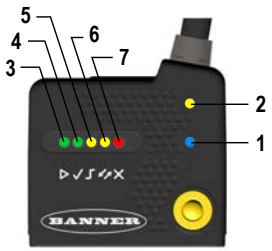
1. Smart Teach Interface
2. Ethernet Connection LED
3. Power LED
4. Button
5. Internal Illuminators
6. Good Read LED (green)
7. Lens
8. Aiming System Laser Source
9. Focus Adjustment Screw
10. Ethernet Cable
11. Power - Serial - I/O Cable

Figure 2. Models with Serial and USB



1.3.1 Indicators

Figure 3. Indicators—Top of Device



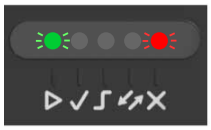
	Indicator	Color	LED Status During Normal Operation
1	Power	Blue	Indicates connection to the power supply
2	Ethernet Connection	Amber	Indicates connection to the Ethernet network
3	READY/Learn	Green	Ready
4	GOOD/Setup	Green	Reading successful
5	TRIGGER/Focus (Aim)	Amber	Reading in progress. Do not trigger a new reading attempt until the current attempt finishes
6	COM/Test	Amber	Active result output transmission on the Main serial or USB ports
7	STATUS	Red	No read result

During the reader startup, all of the LEDs turn on for one second.

See Smart Teach Interface on p. 27 for the colors and meanings of the five LEDs when the reader is in Smart Teach mode.

1.3.2 Diagnostic Indication

Figure 4. Diagnostic Indicators



The **Status** and **Ready** LEDs blink simultaneously to signal the presence of an error. Diagnostic message transmission on interfaces can be enabled to provide details about specific error conditions. See the Diagnostic Error Conditions chart in the Diagnostic page of Barcode Manager.

1.3.3 Button

Use the button for the Smart Teach interface for quick installation without using a PC. The button can be disabled or re-configured to perform additional functions from Barcode Manager.

See .

2 Specifications and Requirements

2.1 Specifications—Reader

Supply Voltage
5 V dc to 30 V dc
10 V dc to 30 V dc with TCNM-ACBB1

Consumption
0.4 A (at 5 V dc) to 0.1 A (at 30 V dc) maximum

Communication Interface
Main RS232 or RS422 full duplex: 2400 bit/s to 115200 bit/s
USB: USB 2.0 Hi-Speed
Ethernet [3]: 10/100 Mbit/s

Inputs
Input 1 (External Trigger) and Input 2: Protected against short-circuits (opto-isolated, polarity insensitive, and PNP only when connected through TCNM-ACBB1, see Inputs on p. 21 for specifications)
Maximum voltage: 30 V dc
Maximum input current: 3.5 mA

Outputs
2 NPN/PNP/Push-Pull software selectable, reverse polarity and short circuit protected outputs available (2 Opto-isolated outputs instead if using TCNM-ACBB1, see Outputs on p. 24 for specifications)
Maximum Current: 100 mA maximum continuous or 145 mA pulsed
Output Saturation Voltage (in PNP or NPN mode): < 1.7 V at 100 mA
Maximum load device voltage drop (in NPN mode): 30 V

Optical Features
Tilt: 0° to 360° within vertical FOV
LED Safety: LED emission according to EN 62471
Laser Safety (Aiming source): IEC60825-1 2007
Lighting System: Internal Illuminator
Aiming System: Laser Indicator

Imager
Image Sensor: CMOS sensor with Global Shutter

	WVGA	1.2 MP
Image Format	752 × 480	1280 × 960
Frame Rate	57 frames/second	36 frames/second
Focus Range [4] Factory calibrated positions (mm)	45 - 70 - 125	45 - 80 - 125

Construction
Aluminum, plastic window

Weight in grams (ounces)
Serial and USB: 117 (4.1) with cable
Serial and Ethernet: 200 (7.1) with cable

Operating Conditions
Operating Temperature: 0 °C to +45 °C (+32 °F to +113 °F)
Storage Temperature: –20 °C to +70 °C (–4 °F to +158 °F)
90% maximum relative humidity (non-condensing)

Vibration Resistance EN 60068-2-6
14 mm at 2 to 10 Hz; 1.5 mm at 13 to 55 Hz; 2 a (a), 70 to 500 Hz; 2 hours on each axis

Shock Resistance EN 60068-2-27
30 g; 11 ms; 3 shocks up and 3 down on each axis

Bump Resistance EN 60068-2-29
30g; 6 ms; 5000 bumps up and 5000 down on each axis

Environmental Rating
IEC IP65

Connections
All models: 1 m (3.3 ft) PVC cable with a 17-pin M12/Euro-style male connector for Power and I/O
Ethernet Models only: 1 m (3.3 ft) PVC cable with 4-pin D-code Euro-style female connector for Ethernet connections

Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.
Supply wiring leads < 24 AWG shall not be spliced.
For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Indicators
Power LED
Ready, Good, Trigger, Com, Status LED
Ethernet Network LED
Green Spot LED

Other
Smart Teach button (configurable via Barcode Manager), beeper

Certifications

[3] The Ethernet interface is compatible with the following application protocols: TCP/IP, EtherNet/IP™, MODBUS® TCP, SLMP, PROFINET®. (The ABR is PROFINET compatible but not PROFINET certified.)
[4] Three factory calibrated positions; continuous focus range for fine tuning
[5] High ambient temperature applications should use metal mounting bracket for heat dissipation.

FCC Statement

Modifications or changes to this equipment without the expressed written approval of Banner Engineering could void the authority to use the equipment.

This device complies with PART 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference which may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2.2 Specifications—Software

Operating Mode

Continuous, One Shot, Phase Mode

Configuration Methods

Smart Teach Human Machine Interface
ABR 3000: Windows-based SW (Barcode Manager) via Ethernet, USB, or Serial Interface
Host Mode Programming sequences sent over Serial or Ethernet TCP interfaces

Parameter Storage

Permanent memory (Flash)

Barcode Types

1-D and stacked		2-D	POSTAL
• PDF417 Standard and Micro PDF417 • Code 128 (GS1-128) • Code 39 (Standard and Full ASCII) • Code 32 • MSI • Standard 2 of 5 • Matrix 2 of 5 • Plessey	• Interleaved 2 of 5 • Codabar • Code 93 • Pharmacode • EAN-8/13-UPC-A/E (including Addon 2 and Addon 5) • GS1 DataBar Family • Composite Symbologies	• Data Matrix ECC 200 (Standard, GS1 and Direct Marking) • QR Code (Standard and Direct Marking) • Micro QR Code • MAXICODE • Aztec Code • Dotcode	• Australia Post • Royal Mail 4 State Customer • Kix Code • Japan Post • PLANET • POSTNET • POSTNET (+BB) • Intelligent Mail • Swedish Post

2.3 PC Requirements—Barcode Manager

Administrative rights are required to install the Barcode Manager software.

Operating System

Microsoft® Windows® operating system version 7, 8, or 10 [6] [7]
Barcode Manager does not currently support Windows Embedded (often used in industrial PCs and/or PLCs)

System Type

32-bit or 64-bit

Hard Drive Space

2 GB hard disk for 64-bit machines; 1 GB hard disk for 32-bit machines

Memory (RAM)

1 GB RAM

Processor

2.00 GHz or faster microprocessor

Screen Resolution

One 19-inch or larger monitor, optimized for 1280×1024 resolution

Third-Party Software

Web Browser: Google Chrome, Mozilla Firefox, Microsoft Internet Explorer, Opera, etc.

Connection

100 Base-T Ethernet

2.4 Dimensions

All measurements are listed in millimeters [inches], unless noted otherwise.

Note: Engaging the mounting screws more than 3.5 mm will damage the device.

[6] Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.
[7] Barcode Manager no longer supports Windows XP.

Figure 5. Overall Dimensions of ABR 3000 Ethernet Models

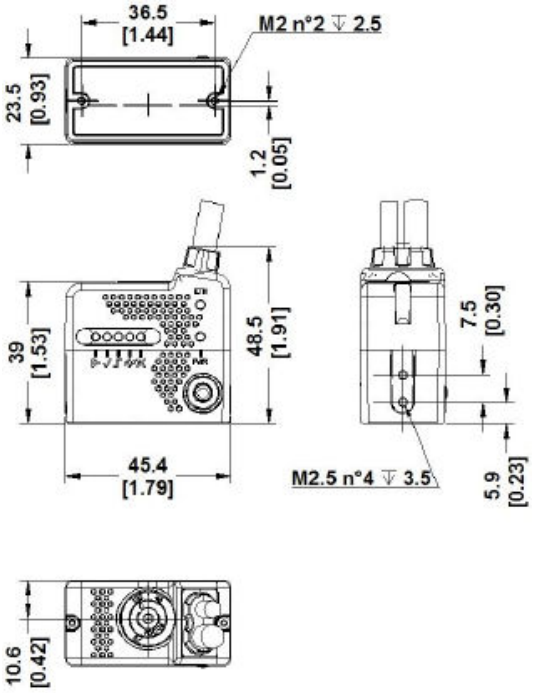
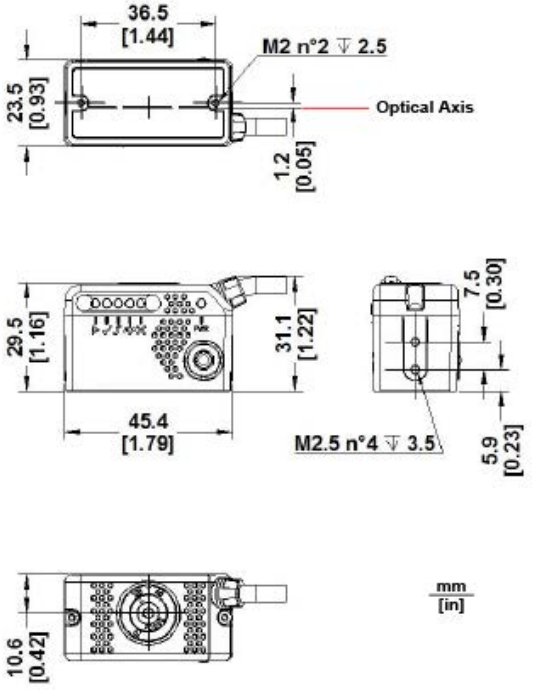


Figure 6. Overall Dimensions of ABR 3000 USB Models



3 Installation Instructions

3.1 Handling

Proper handling ensures that the ABR will function correctly.

The ABR is designed for use in an industrial environment. It is built to withstand vibration and shock when correctly installed. However, it is also a precision product and before and during installation it must be handled properly to avoid damage.

- Do not drop the device (exceeding shock limits)
- Do not fine tune the positioning by striking the device or the bracket
- Do not weld the device into position; this can cause electrostatic, heat, or reading window damage
- Do not spray paint near the reader; this can cause reading window damage

3.2 Set the Focus

The reader is factory-calibrated at three focus positions (45 mm, 70 mm, and 125 mm for WVGA models; 45 mm, 80 mm, and 125 mm for 1.2 MP models). The focus range is continuous to provide fine-tuning for your application. This means you can select a focus position different than these three positions.

1. Determine the focus position needed for your application. The following tables show the reading ranges at the three focus positions for Code 128 (1D) and Data Matrix (2D) 10 mil resolution codes.

Table 2: WVGA Models

Focus Position (mm)	Horizontal Field of View	Reading Range (Depth of Field)	
		1D	2D
45	38 mm (1.5 in)	30 mm to 80 mm (1.2 in to 3.1 in)	25 mm to 70 mm (1.0 in to 2.8 in)
70	56 mm (2.2 in)	60 mm to 125 mm (2.4 in to 4.9 in)	45 mm to 100 mm (1.8 in to 3.9 in)
125	95 mm (3.7 in)	95 mm to 155 mm (3.7 in to 6.1 in)	65 mm to 120 mm (2.6 in to 4.7 in)

Table 3: 1.2 MP Models

Focus Position (mm)	Horizontal Field of View	Reading Range (Depth of Field)	
		1D	2D
45	52 mm (2.0 in)	25 mm to 90 mm (1.0 in to 3.5 in)	30 mm to 65 mm (1.2 in to 2.6 in)
80	86 mm (3.4 in)	65 mm to 145 mm (2.6 in to 5.7 in)	55 mm to 105 mm (2.2 in to 4.1 in)
125	130 mm (5.1 in)	105 mm to 180 mm (4.1 in to 7.1 in)	80 mm to 125 mm (3.1 in to 4.9 in)

2. Using a 2.5 mm hex key, rotate the focus ring at the back of the reader to one of the three pre-calibrated distances or to the desired distanced according to your application.

CAUTION: Do not rotate the focus ring beyond the focus scale limits; damage to the focus mechanism can occur.

Refer to the Reading Diagrams in Reading Diagrams on p. 100 which show the reading ranges at the different focus positions for Code 128 (1D) and Data Matrix (2D) codes.

3.3 Mount the Reader

Note: Mount the device at a 10° to 15° angle from the target to avoid direct reflections.

1. If a bracket is needed, mount the device onto the bracket.
2. Mount the device (or the device and the bracket) to the machine or equipment at the desired location. Do not tighten the mounting screws at this time.

CAUTION: Always use the included washers, which help prevent over-insertion. Engaging the mounting screws more than 3.5 mm will damage the device.

3. Check the device alignment.
4. Tighten the mounting screws to secure the device (or the device and the bracket) in the aligned position.

3.4 Position the Reader

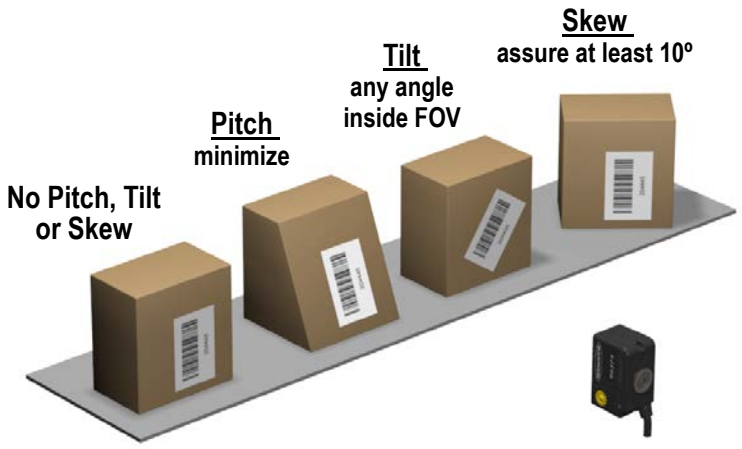
The ABR is able to decode code labels at a variety of angles; however significant angular distortion may degrade reading performance.

When mounting the ABR, consider these ideal label position angles: Pitch or Skew 10° to 20° and Tilt 0°. The reader can read a code at any tilt angle provided the code fits into the Field Of View (FOV).

Note: Because the ABR is omni-directional on the code plane, the Pitch and Skew angles have the same significance with respect to the code plane. However in some advanced code reading applications performance can be improved by modifying the Skew angle.

The Pitch, Skew and Tilt angles are represented in the following figure.

Figure 7. Code Reading Orientation—Pitch, Tilt, and Skew Angles



Use the follow the suggestions for the best orientation:

- Position the reader to avoid the direct reflection of the light emitted by the ABR reader. It is best to use at least 10° for the Skew angle
- Use a Pitch or Skew angle of 0° in some cases, such as low contrast or low illumination
- Align the reader to fit linear barcodes into the horizontal FOV for best performance (because linear barcodes are rectangular). The ABR can read labels with any tilt angle.

Figure 8. Code in FOV

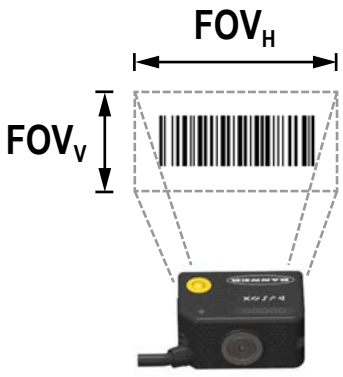


Figure 9. Code Out of FOV Due to Tilt Angle



See for FOV vs. Reading Distance considerations.

3.5 Focus Lock Label—Optional

There are five single-use focus lock labels included in the packaging that can be used to protect the focus position from being changed after the application has been completed.

These are adhesive labels that are designed to be applied over the focus screw.

Figure 10. Focus Lock Label



3.6 Typical Layouts

The following typical layouts refer to system hardware configurations. However, they also require the correct setup of the software configuration parameters. Dotted lines in the figures refer to optional hardware configurations within the particular layout. Most examples show the optional, but recommended, TCNM-ACBB1 connection box (see TCNM-ACBB1 Electrical Connections on p. 19).

Important:

When using a TCNM-ACBB1 with an ABR 3000:

- The Input setting Line Type must be set to PNP
- The Trigger and Input 2 indicator LED's are not functional in the TCNM-ACBB1 box
- Any input signals to the TCNM-ACBB1 must be PNP current sourcing signals
- The DB9 AUX serial port connector in the TCNM-ACBB1 will not function; the ABR 3000only has a MAIN serial port

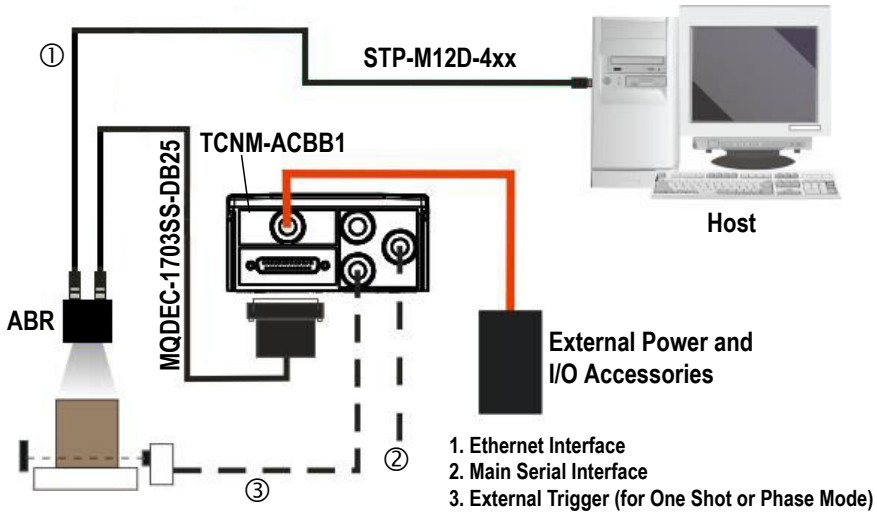
Important: ABR 3000 readers do not have auxiliary serial interfaces. Therefore neither data monitoring nor device configuration can be performed through this interface.

ABR 3000 readers can be configured in Barcode Manager through the Ethernet, Main Serial, or USB interfaces depending on the reader model.

3.6.1 Ethernet Connection

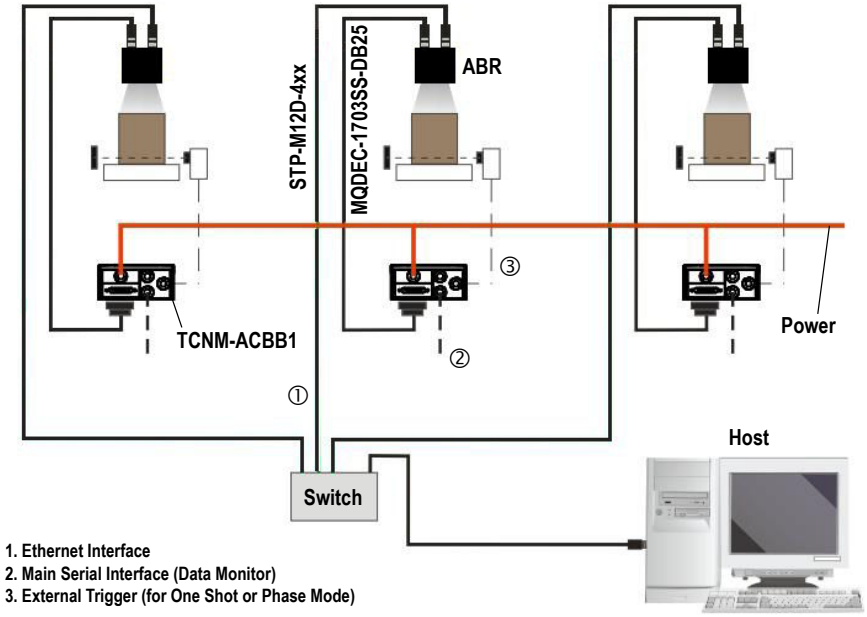
The Ethernet connection is possible in two different layouts. In a Point-to-Point layout the reader is connected to a local host by using a STP-M12D-4xx cable. There is no need to use a crossover adapter because ABR incorporates an autocross function.

Figure 11. Ethernet Point-to-Point Layout



When using a Local Area Network (LAN), one or more ABR readers can be connected to the network using STP-M12D-4xx cables.

Figure 12. Ethernet Network Layout



3.6.2 Serial or I/O Connections on USB Models

The CSB-M121701USB02M121702 accessory Y-cable allows the USB interface to be used with input/output signals between the ABR 3000 reader and the I/O devices.

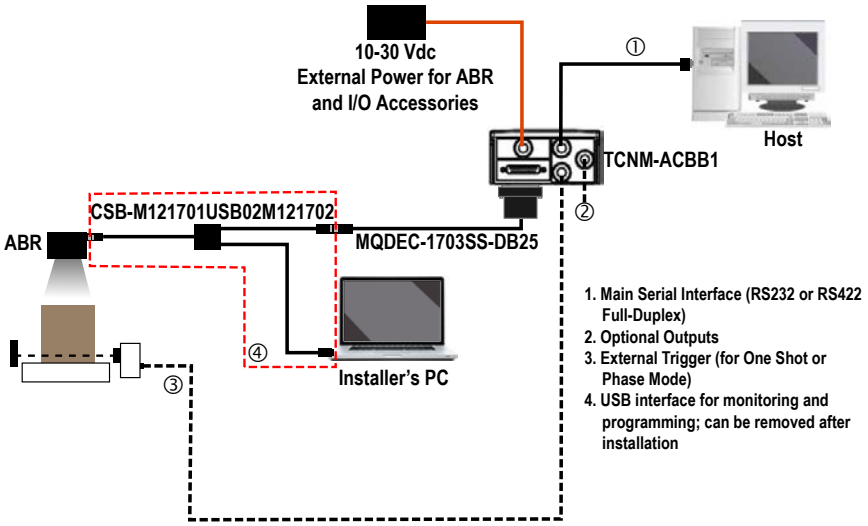
To connect the system in a Serial point-to-point configuration using a connection box, you need the hardware indicated in Figure 13 on p. 13. In this layout, the data is transmitted to the Host from the ABR main serial interface.

ABR power and I/O device connections take place through the TCNM-ACBB1 connection box using the MQDEC-1703SS-DB25 accessory cable.

If a connection box is not used, the MQDEC-1703SS-DB25 cable could be replaced with a MQDC2S-17xx cable to wire to the I/O devices directly. In this case the I/O will be referenced to ground, which is connected to both the USB and I/O side of the Y connector.

When One Shot or Phase Mode operating mode is used, the reader can be activated by an External Trigger (for example a pulse from a photoelectric sensor) when the object enters its reading zone.

Figure 13. Serial Interface Point-to-Point Layout for USB Models



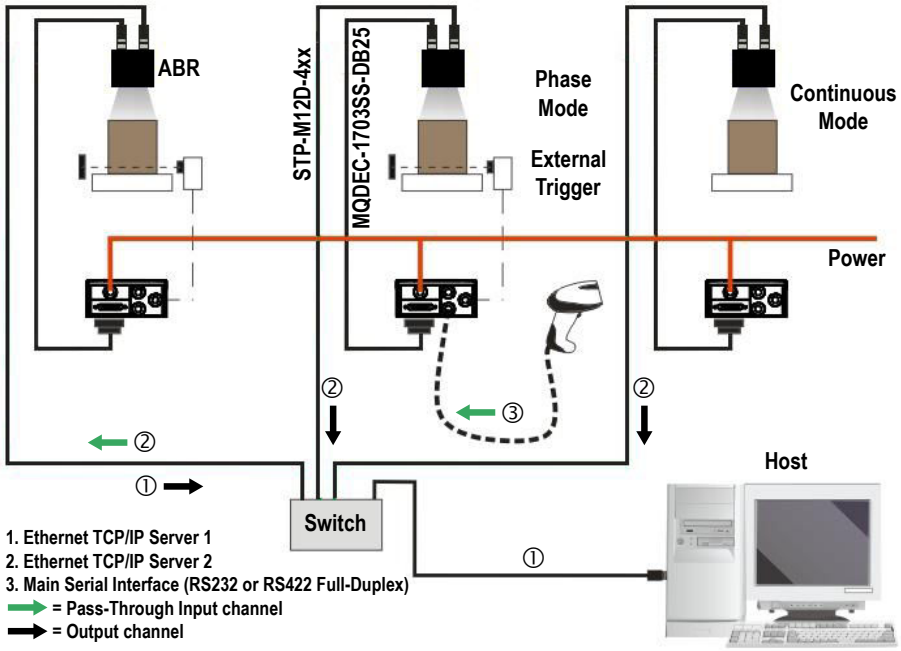
All devices always support multiple output channels (that is, for data monitoring).

3.6.3 Pass-Through

The pass-through layout allows each device working alone, to collect data from one or more pass-through input channels and send this data plus its own on one or more different output channels.

In this way independent devices can be connected together in combinations to create multi device networks. Many devices reading independently can send their messages through a common output channel which instead of being directed at a Host can be collected by another device on its pass-through input channel and sent to a Host on a different output channel.

Figure 14. Pass-Through Layout



In a Pass-through layout each device supports multiple pass-through configurations to accept input from different devices on different channels (middle reader, above). However, readers are not required to have a pass-through configuration if they don't need to receive data from an input channel (right reader, above). The overall data collection device always has at least one pass-through configuration to collect the input data from the other devices and send it to the Host (left reader, above).

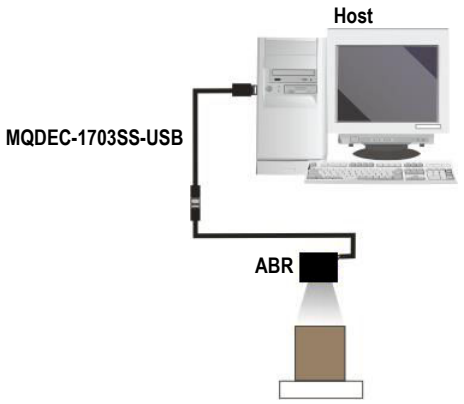
All devices always support multiple output channels (that is, for data monitoring).

In a Pass-through layout each device can have a different operating mode: Continuous, One Shot, Phase Mode, etc.

3.6.4 USB Connection

For ABR 3000 models, the USB connection is possible in different layouts.

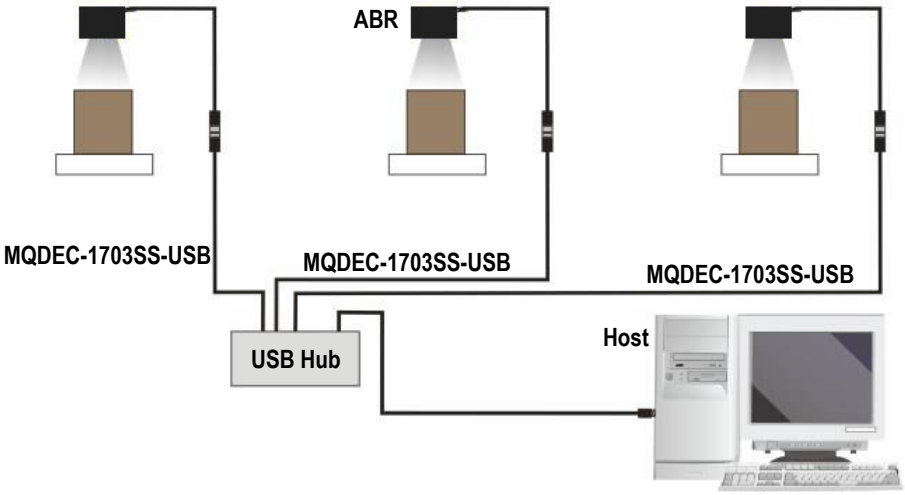
Figure 15. USB Point-to-Point Layout



Note: USB-HID (Keyboard Wedge) configurations can also be made through this interface. See USB-HID (Keyboard Wedge) Configurations on p. 39.

One or more ABR 3000 USB models can be connected to a USB Hub. The HUB must be able to supply 500 mA to each port.

Figure 16. USB Layout to Hub



3.7 Connector Descriptions

The connector pinouts and notes given in this section are for typical cabling applications.

3.7.1 Power, Communications, and I/O Connector

The ABR reader is equipped with an M12 17-pin male connector for connection to the power supply, serial interfaces and input/output signals. The details of the connector pins are indicated in the following table.

Figure 17. M12 17-pin male COM, I/O and Power Connector

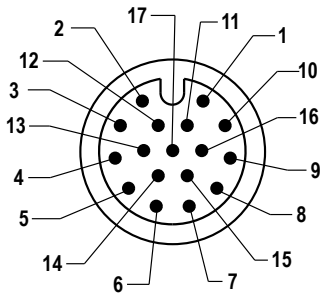


Table 4: Power and I/O Pinouts for MQDC2S-17xx

Pin	Wire Color	Description	
1	Brown	Power Supply Input Voltage + (V dc)	
2	Blue	Power Supply Input Voltage - (GND)	
3	White	not connected	
4	Green	not connected	
5	Pink	Reserved	
6	Yellow	External Trigger	
7	Black	USB Data+ [8]	
8 [9]	Gray	Output 2	
9 [9]	Red	Output 1	
13	White/Green	Input Signal 2	
14	Brown/Green	not connected	
15	White/Yellow	USB Data - [8]	
16	Yellow/Brown	not connected	
Shield	n/a	Cable shield connected to chassis and 17-pin connector shell	
		RS232 Main Serial Interface	**RS422 FD Main Serial Interface**
10	Violet	-	RX- [10]
11	Gray/Pink	RX	RX+ [10]
12	Red/Blue	-	TX-
17	White/Gray	TX	TX+

All wires are referenced to GND, so any connected serial or I/O device must share a connection to GND.

If using a TCNM-ACBB1 connection box, connect the reader using cable MQDEC-1703SS-DB25 and for wiring details, see TCNM-ACBB1 Electrical Connections on p. 19.

For Ethernet models, use Cat 5e or superior M12 D-code cables, such as STP-M12D-4xx.

To meet EMC requirements:

- Connect the reader chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm
- Conect pin "Earth" of the TCNM-ACBB1 connection box to a good earth ground

[8] If using the USB interface without Banner accessory cables, EMC compliance requires USB data and power signals to originate from the same source (computer). Maximum USB cable length from M12 17-pin connector is 2 meters. Incorrect disconnection can result in damage to the USB hub.

[9] Referenced to GND; Outputs become opto-isolated and polarity sensitive when connected through the TCNM-ACBB1 connection box. For details, see see TCNM-ACBB1 Electrical Connections on p. 19.

[10] If using RS422, do not leave floating. For details, see RS422 Full-Duplex Interface on p. 21.

3.7.2 Inputs

There are two non opto-isolated inputs available on the M12 17-pin connector of the reader: Input 1 (External Trigger) and Input 2, a generic input.

The electrical features of both inputs are:

	INPUT	V_{IN} Minimum	V_{IN} Maximum	I_{IN} Maximum
NPN	OFF [11]	4 V	30 V	0 mA
	ON	0 V	2.5 V	0.3 mA
PNP	OFF [11]	0 V	2.5 V	0 mA
	ON	4 V	30 V	3.5 mA

The relative pins on the M12 17-pin connector are:

Pin	Name	Function
2	GND	Power Supply Input Voltage -
6	I1A	External Trigger (referenced to GND)
13	I2A	Input Signal 2 (referenced to GND)

3.7.3 Outputs

Two general purpose non opto-isolated but short circuit protected outputs are available on the M12 17-pin connector of the reader.

The electrical features of the two outputs are the following:

Outputs

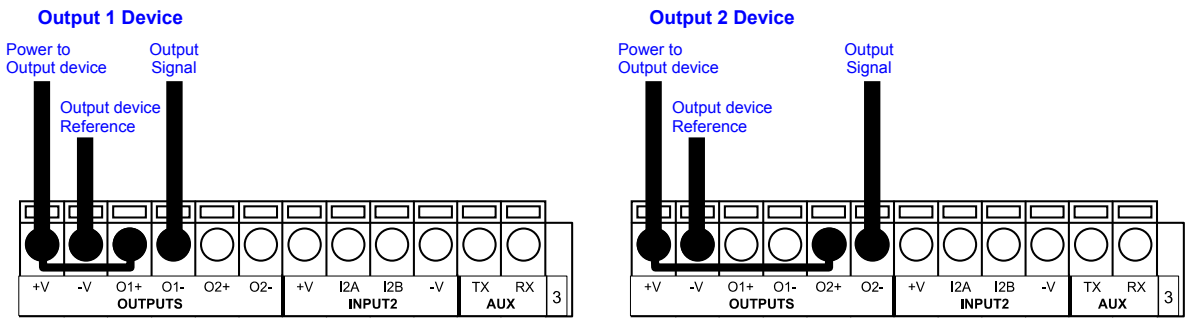
2 NPN/PNP/Push-Pull software selectable, reverse polarity and short circuit protected outputs available (2 Opto-isolated outputs instead if using TCNM-ACBB1, see Outputs on p. 24 for specifications)
Maximum Current: 100 mA maximum continuous or 145 mA pulsed
Output Saturation Voltage (in PNP or NPN mode): < 1.7 V at 100 mA
Maximum load device voltage drop (in NPN mode): 30 V

The pinout is the following:

Pin	Name	Function
2	GND	Power Supply Input Voltage -
8	O2	Output 2 (referenced to GND)
9	O1	Output 1 (referenced to GND)

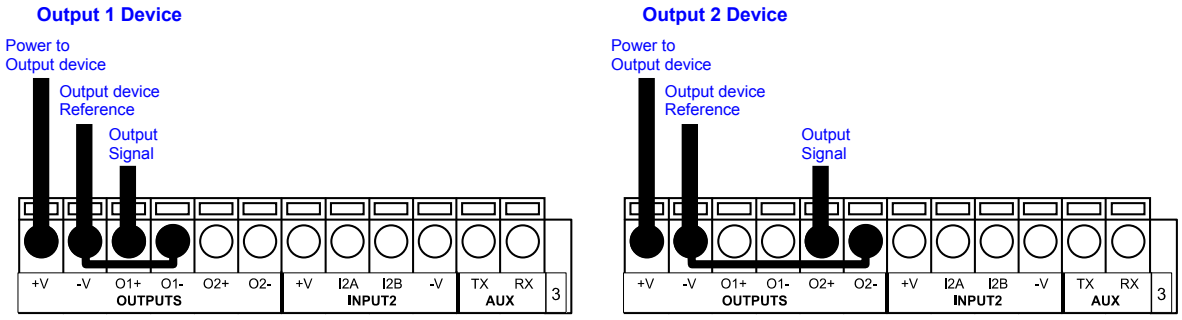
The output signals are fully programmable being determined by the configured Activation/Deactivation events, Deactivation Timeout or a combination of the two. For further details refer to the Help On Line page for the Output Setup step in Barcode Manager.

Figure 18. PNP Output Connection



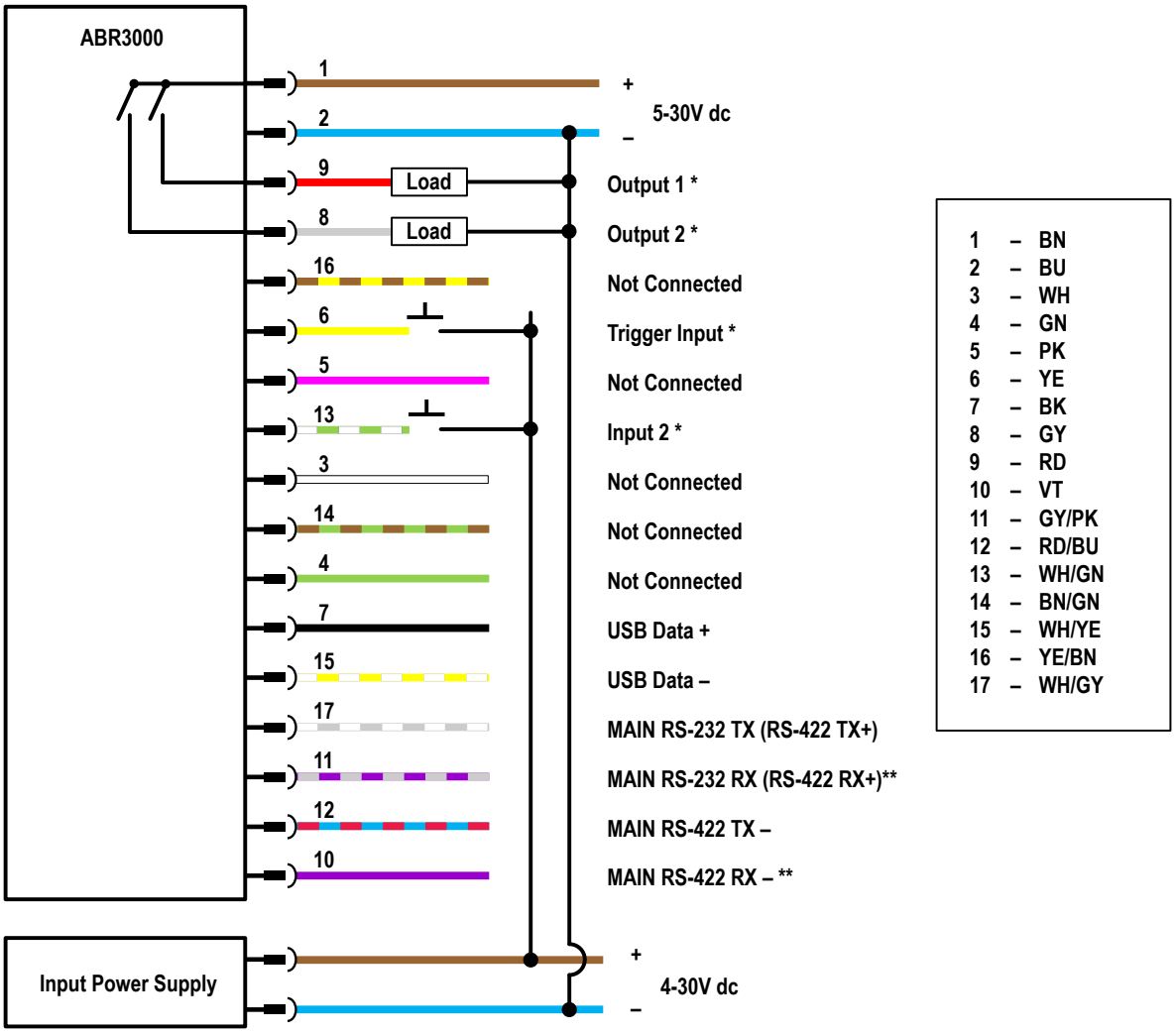
[11] The OFF state is guaranteed even if the input is floating.

Figure 19. NPN Output Connection



3.7.4 Wiring

Figure 20. PNP Inputs and Outputs

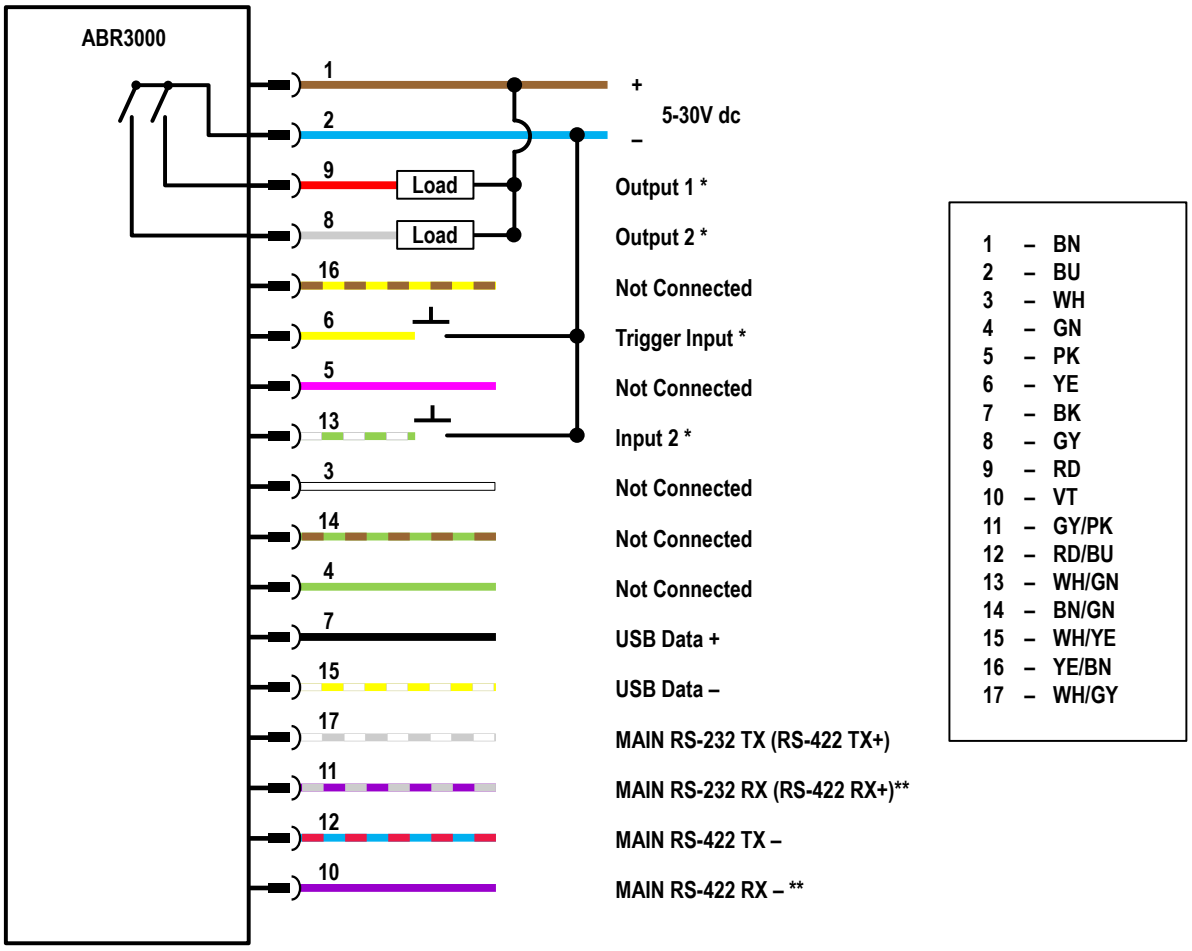


This is a typical example. Applications may vary.

*** Input and Output Line Types set to PNP in Barcode Manager**

**** If using RS-422, but not using RX+ and RX–, connect these two to –V dc or Ground**

Figure 21. NPN Inputs and Outputs



This is a typical example. Applications may vary.

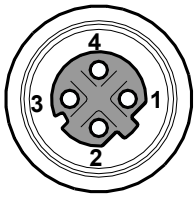
*** Input and Output Line Types set to NPN in Barcode Manager**

**** If using RS-422, but not using RX+ and RX–, connect these two to –V dc or Ground**

3.7.5 Ethernet Connector

A Standard M12 D-Coded female connector is provided for the Ethernet connection. This interface is IEEE 802.3 10 BaseT and IEEE 802.3u 100 BaseTx compliant.

Figure 22. M12 D-Coded Female Ethernet Network Connector



Pin	Name	Function
1	TX +	Transmitted data (+)
2	RX +	Received data (+)
3	TX -	Transmitted data (-)
4	RX -	Received data (-)

3.7.6 Ethernet Interface

The Ethernet interface can be used for TCP/IP communication with a remote or local host computer by connecting the reader to either a LAN or directly to a host PC. There is no need to use a crossover adapter since ABR incorporates an auto-cross function.

A STP-M12D-4xx can be used to connect to a LAN.

On the ABR Ethernet interface the following communication channels are available:

- TCP Client
- TCP Server
- UDP Channel
- FTP Client

The following Industrial Ethernet protocols are compatible over the Ethernet interface:

- EtherNet/IP™ [12]
- MODBUS® TCP Client [13]
- MODBUS® TCP Server [13]
- SLMP
- PROFINET® [14]

3.8 TCNM-ACBB1 Electrical Connections

All ABR models can be connected to a TCNM-ACBB1 connection box through the MQDEC-1703SS-DB25 accessory cable. This cable terminates in an M12 17- pin connector on the ABR side and in a 25-pin male D-sub connector on the TCNM-ACBB1 side.

Make system connections through one of the TCNM-ACBB1 connection boxes because they offer the advantages of easy connection, easy device replacement, opto-isolated outputs (Outputs 1 and 2), and filtered reference signals.

Use this pinout **only** when the ABR is connected to the TCNM-ACBB1 by means of the MQDEC-1703SS-DB25 accessory cable.

When using a TCNM-ACBB1 with an ABR 3000:

- The Input setting Line Type must be set to PNP
- The Trigger and Input 2 indicator LED's are not functional in the TCNM-ACBB1 box
- Any input signals to the TCNM-ACBB1 must be PNP current sourcing signals
- The DB9 AUX serial port connector in the TCNM-ACBB1 will not function; the ABR 3000only has a MAIN serial port

TCNM-ACBB1 Terminal Block Connectors	
Input Power	
Vdc	Power Supply Input Voltage +
GND	Power Supply Input Voltage -
Earth	Protection Earth Ground
Inputs	
+V	Power Source – External Trigger
I1A	External Trigger A (polarity insensitive)
I1B	External Trigger B (polarity insensitive)
-V	Power Reference – External Trigger
+V	Power Source – Inputs

[12] EtherNet/IP™ is a trademark of ODVA, Inc.
[13] MODBUS® is a registered trademark of Schneider Electric USA, Inc.
[14] PROFINET® is a registered trademark of PROFIBUS Nutzerorganisation e.V.

TCNM-ACBB1 Terminal Block Connectors		
I2A	Input 2 A (polarity insensitive)	
I2B	Input 2 B (polarity insensitive)	
-V	Power Reference – Inputs	
Outputs		
+V	Power Source - Outputs	
-V	Power Reference - Outputs	
O1+	Output 1 + opto-isolated and polarity sensitive	
O1-	Output 1 - opto-isolated and polarity sensitive	
O2+	Output 2 + opto-isolated and polarity sensitive	
O2-	Output 2 - opto-isolated and polarity sensitive	
Shield		
Shield	Cable shield connected to chassis and 17-pin connector shell	
Main Interface		
	RS232	**RS422 Full-Duplex**
	TX	TX+
	RX	RX+ [15]
	-	TX-
	-	RX- [15]
	SGND	SGND

Important: Do not connect GND and SGND to different (external) ground references. GND and SGND are internally connected through filtering circuitry which can be permanently damaged if subjected to voltage drops over 0.8 V dc.

3.8.1 Power Supply

Power can be supplied to the reader through the TCNM-ACBB1 spring clamp terminal pins.

The power must be between 10 V dc and 30 V dc only.

It is recommended to connect the device CHASSIS to earth ground (Earth) by setting the appropriate jumper in the TCNM-ACBB1 connection box. See p/n 174477 *TCNM-ACBB1 Installation Manual*, available at www.bannerengineering.com, for details.

3.8.2 Main Serial Interface

The signals relative to the following serial interface types are available on the TCNM-ACBB1 spring clamp terminal blocks.

The main serial interface type and its parameters (baud rate, data bits, etc.) can be defined by the user via Barcode Manager. For more details refer to the Help On Line page of the Reading Phase step (Channels) in Barcode Manager.

Details regarding the connections and use of the interfaces are given in the following sections.

RS232 Interface

The RS232 interface is generally used for Point-to-Point connections. When it is connected to the host computer it allows transmission of code data.

The following pins are used for RS232 interface connection:

[15] Do not leave floating. See RS422 Full-Duplex Interface on p. 21 for connection details.

TCNM-ACBB1	Function
TX	Transmit Data
RX	Receive Data
SGND	Signal Ground

Shielded cables are recommended. The overall maximum cable length must be less than 15 m (49.2 ft).

RS422 Full-Duplex Interface

The RS422 full-duplex (5 wires + shield) interface is used for non-polled communication protocols in point-to-point connections over longer distances (maximum 1200 m / 3940 ft) than those acceptable for RS232 communications or in electrically noisy environments.

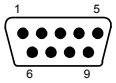
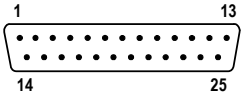
The TCNM-ACBB1 pinout follows:

TCNM-ACBB1	Function
TX+	RS422 Transmit Data +
RX+	RS422 Receive Data +
TX-	RS422 Transmit Data -
RX-	RS422 Receive Data -
SGND	Signal Ground

Note: For applications that do not use RS422 transmission to the reader (terminal block RX+ and RX- signals), do not leave these lines floating but connect them to SGND.

3.8.3 User Interface—Serial Host

The following table contains the pinout for standard RS232 PC Host interface. For other user interface types please refer to their own manual.

RS232 PC-Side Connections			
 9-pin male connector		 25-pin male connector	
Pin	**Name**	**Pin**	**Name**
2	RX	3	RX
3	TX	2	TX
5	GND	7	GND

3.8.4 Inputs

There are two opto-isolated, polarity insensitive inputs available through the TCNM-ACBB1 that require PNP input signals to use with an ABR 3000: Input 1 (External Trigger) and Input 2, a generic input.

The External Trigger can be used in One Shot Mode or in Phase Mode. Its main functions are:

- Acquisition trigger in One Shot Mode
- Reading phase-ON/reading phase-OFF command in Phase Mode

The main functions of the general purpose Input 2 are:

- Second external trigger in Phase Mode
- Match code storage command when the Match Code option is enabled

The electrical features of both inputs are:

V_{AB} = 30 V dc maximum
I_{IN} = 10 mA (reader) + 12 mA (TCNM-ACBB1) maximum

The active state of these inputs are selected in software.

An anti-disturbance filter, by default, is implemented in software on both inputs. The value can be changed through the software parameter Debounce Filter. See the Help On Line page of the Reading Phase step (Inputs) in Barcode Manager for further details on these parameters.

Note: Polarity insensitive inputs assure full functionality even if pins A and B are exchanged.

The connections are indicated in the following diagrams:

TCNM-ACBB1	Function
+V	Power Source - External Trigger
I1A	External Trigger A (polarity insensitive)
I1B	External Trigger B (polarity insensitive)
-V	Power Reference - External Trigger

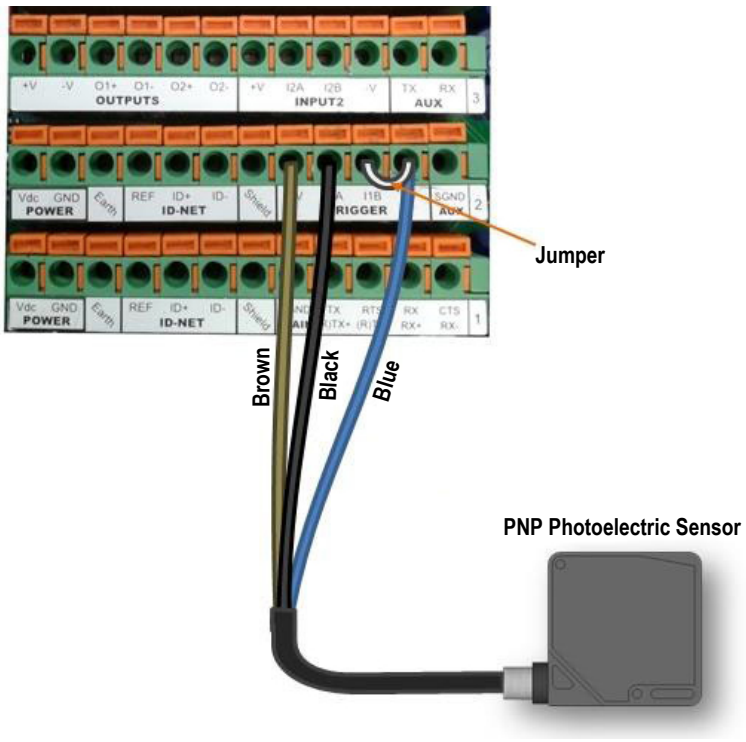
When using a TCNM-ACBB1 with an ABR 3000:

- The Input setting Line Type must be set to PNP
- The Trigger and Input 2 indicator LED's are not functional in the TCNM-ACBB1 box
- Any input signals to the TCNM-ACBB1 must be PNP current sourcing signals
- The DB9 AUX serial port connector in the TCNM-ACBB1 will not function; the ABR 3000only has a MAIN serial port

External Trigger Input Connections Using ABR Power

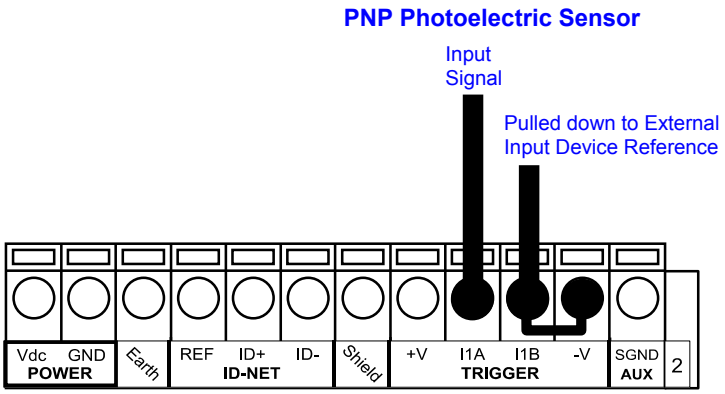
CAUTION: Power from the Vdc/GND spring clamps is available directly to the Input Device on the +V/-V spring clamps, and does not pass through the Power Switch (ON/OFF) inside the TCNM-ACBB1. Disconnect the power supply when working inside the TCNM-ACBB1.

Figure 23. PNP External Trigger Using ABR Power



External Trigger Input Connections Using External Power

Figure 24. PNP External Trigger Using External Power

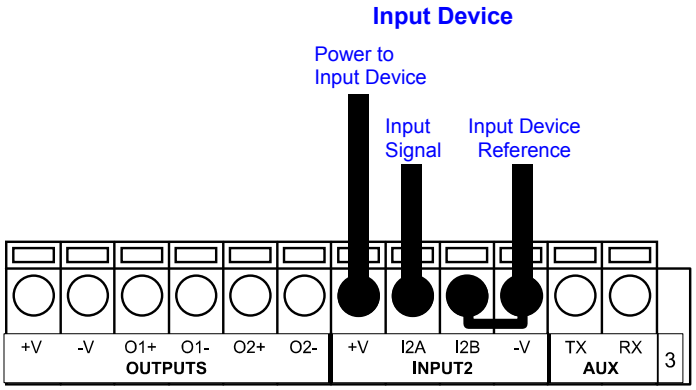


TCNM-ACBB1	Function
+V	Power Source - Inputs
I2A	Input 2 A (polarity insensitive)
I2B	Input 2 B (polarity insensitive)
-V	Power Reference - Inputs

Input 2 Connections Using ABR Power

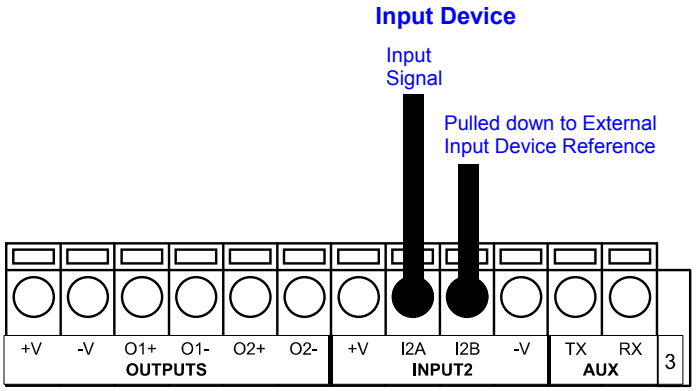
CAUTION: Power from the Vdc/GND spring clamps is available directly to the Input Device on the +V/-V spring clamps, and does not pass through the Power Switch (ON/OFF) inside the TCNM-ACBB1. Disconnect the power supply when working inside the TCNM-ACBB1.

Figure 25. PNP Input 2 Using ABR Power



Input 2 Connections Using External Power

Figure 26. PNP Input 2 Using External Power



3.8.5 Outputs

CAUTION: When Outputs 1 and 2 are connected through the TCNM-ACBB1 connection box, they become opto-isolated and polarity sensitive and acquire the electrical characteristics listed below. To function correctly, they require setting the Output Line Type configuration parameters to NPN for the respective output. The hardware connection to the TCNM-ACBB1 can be either NPN or PNP.

Two general purpose outputs are available and their meaning can be defined by the user. They are typically used either to signal the data collection result or to control an external lighting system.

TCNM-ACBB1	Function
+V	Power Source - Outputs
O1+	Output 1 + opto-isolated and polarity sensitive
O1-	Output 1 - opto-isolated and polarity sensitive
O2+	Output 2 + opto-isolated and polarity sensitive
O2-	Output 2 - opto-isolated and polarity sensitive
-V	Power Reference Outputs

The electrical features of the outputs are the following:

2 opto-isolated NPN or PNP, reverse polarity and short circuit protected outputs available
Maximum Current: 40 mA maximum continuous or 130 mA pulsed
Output Saturation Voltage (in PNP or NPN mode): < 1 V at 10 mA
Maximum load device voltage drop (in NPN mode): 30 V
Power Dissipation: 90mW maximum at 50 °C (122 °F) ambient temperature

By default, Output 1 is associated with the No Read event, which activates when the code(s) signaled by the external trigger are not decoded. Output 2 is associated with the Good Read event, which activates when all the selected codes are correctly decoded.

The output signals are fully programmable being determined by the configured Activation/Deactivation events, Deactivation Timeout or a combination of the two. Refer to the Barcode Manager parameters Help On Line for further details.

Output 1 and 2 Connections Using ABR Power

CAUTION: Power from the Vdc/GND spring clamps is available directly to the Output Device on the +V/-V spring clamps, and does not pass through the Power Switch (ON/OFF) inside the TCNM-ACBB1. Disconnect the power supply when working inside the TCNM-ACBB1.

Figure 27. PNP/Open Emitter Output Using ABR Power

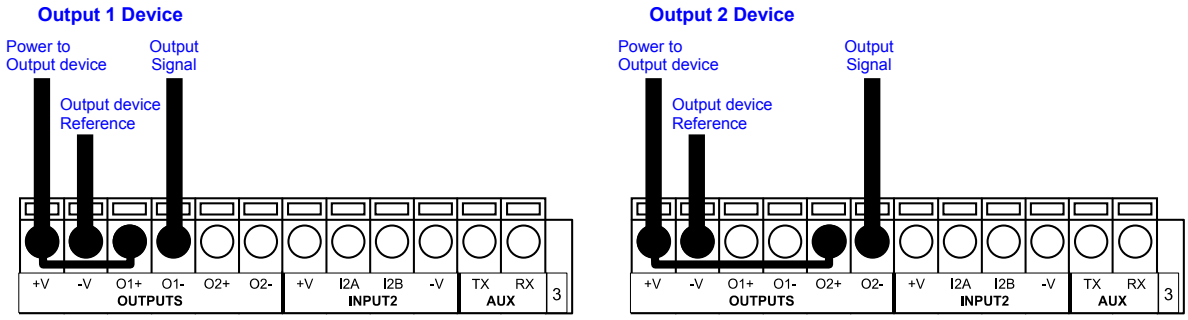
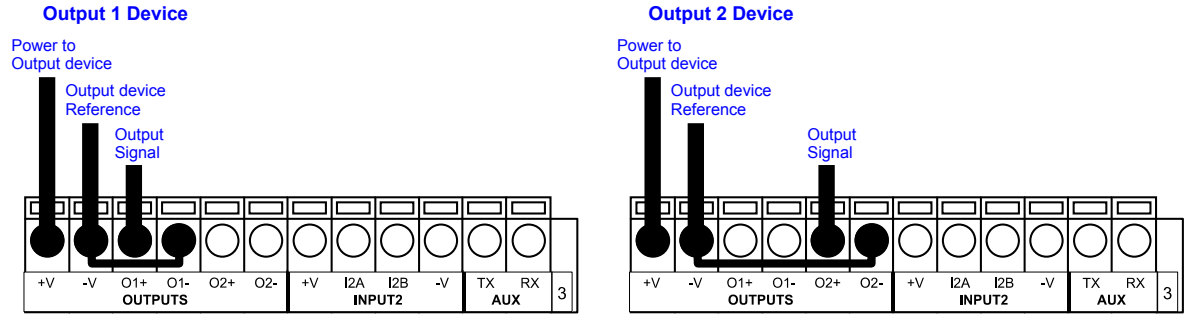


Figure 28. NPN/Open Collector Output Using ABR Power



Output 1 and 2 Connections Using External Power

CAUTION: If output devices are powered externally (separate from ABR power), it is always advised to maintain the same voltage levels used for the ABR device.

Figure 29. PNP/Open Emitter Output Using External Power

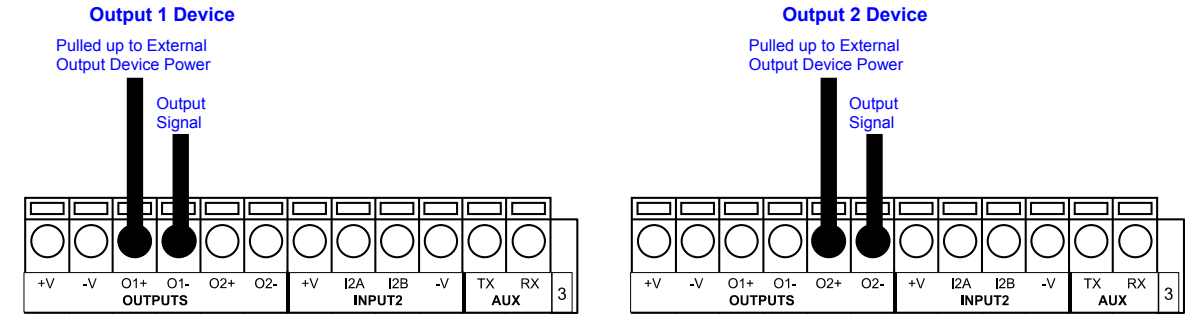
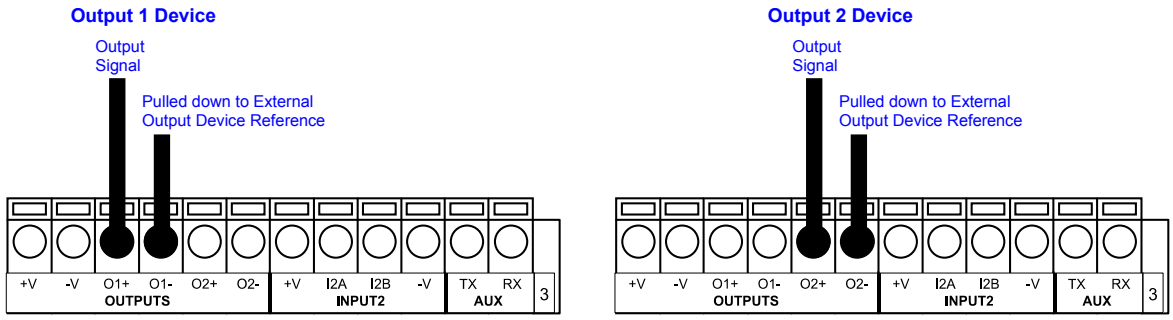


Figure 30. NPN/Open Collector Output Using External Power



Output 3 is not opto-isolated but can be assigned to the same events. By default it is not assigned to any event.

Note: For this output, set the Line Type configuration parameter according to the hardware connection to the TCNM-ACBB1: NPN, PNP or Push-Pull.

4 Smart Teach Interface

Smart Teach is designed to improve ease of installation and maintenance.

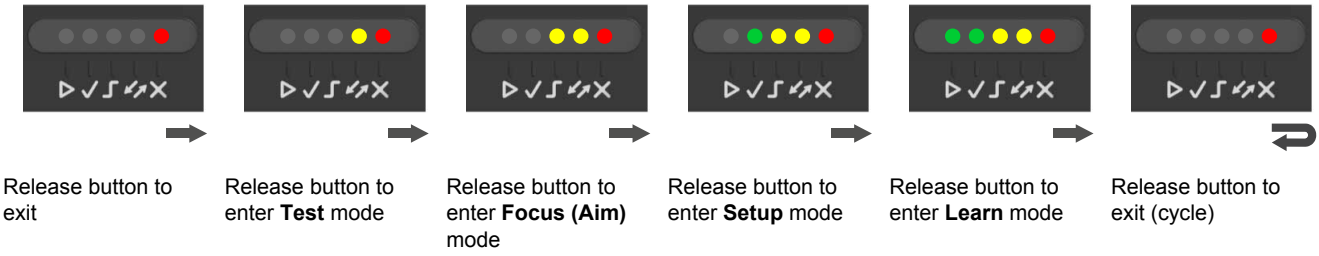
Status information is clearly presented by means of the five colored LEDs. The single push button provides access to the following modes.

Icon	Description
	Test Mode includes bar graph visualization to check static reading performance.
	Focus (Aim) turns on the laser aiming cross to aim the reader at the target.
	Setup self-optimizes and auto-configures image brightness parameters.
	Learn automatically detects and recognizes a single code which is presented to it. Successive Learns will substitute the current code. To configure multiple codes, use Barcode Manager.

Quick access to the following modes is provided using the push button:

1. Press the button. The **Status** LED gives visual feedback.
2. Hold the button until the specific mode LED is on (**Test**, **Focus/Aim**, **Setup**, or **Learn**).
3. Release the button to enter the specific mode.

After the button is pressed, the cycle of LED activation is as follows:



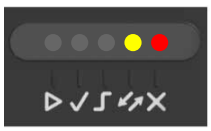
Release button to exit | Release button to enter **Test** mode | Release button to enter **Focus (Aim)** mode | Release button to enter **Setup** mode | Release button to enter **Learn** mode | Release button to exit (cycle)

4.1 Test Mode

Test mode can be used to test the reading performance of the system. Use a code suitable for your application.

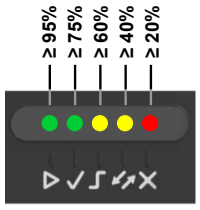
1. Enter the Test function by pressing and holding the Smart Teach button until the **Test** LED is on.
2. Release the button to enter the Test function.
   Once entered, the bar graph on the five LEDs is activated and if the reader starts reading codes the bar graph shows the good read rate.

Figure 31. Smart Teach Interface: Test Function



The bar graph has the following meaning, referring to the actual percentage of good reads:

Figure 32. Test Function Bar Graph



In case of No Read condition, only the **Status** LED (red) is on and blinks.

3. To exit the test, press the Smart Teach button once.

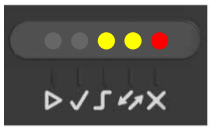
Note: By default, the Test exits automatically after three minutes.

4.2 Focus/Aiming

The reader includes a built-in aiming system to aid in reader positioning. Access the aiming system through the Smart Teach Interface.

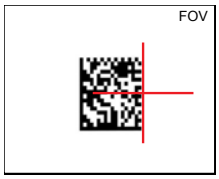
1. Apply power to the reader.
   During startup, all of the LEDs blink for one second. On the connector side of the reader near the cable, the **Power** LED (blue) indicates the reader is correctly powered.
2. Enter **Focus/Aim** mode by pressing and holding the Smart Teach button until the **Focus/Aim** LED is on.

Figure 33. Smart Teach Interface: Aim Mode



3. Release the button to enter **Aim** mode.
   The aiming system turns on.
4. Place an application-specific code in front of the reader at the reading distance indicated for your model (see Set the Focus on p. 9).
5. Position the center of the code 8 mm to the left of the aiming system indicator, as shown in the following figure.

Figure 34. Aiming Mode Using the Red Crosshairs



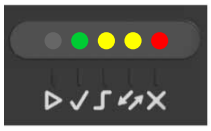
6. Exit **Aim** mode by pressing the Smart Teach button once. The aiming system turns off.

4.3 Setup

Once entered, the imager automatically performs the Image Acquisition parameter calibration for the specific code presented to it.

1. Enter **Setup** mode by pressing and holding the Smart Teach button until the **Setup** LED is on.

Figure 35. Smart Teach Interface: Setup Mode



2. Release the button to enter **Setup** mode.

   The **Setup** LED blinks until the procedure is completed. The **Setup** procedure ends when the Image Acquisition parameters are successfully saved in the reader memory, the **Setup** LED stops blinking, the ABR beeps once, and exits **Setup** mode.
3. If the calibration cannot be reached after a timeout of about 5 (five) seconds, ABR exits without saving the parameters to memory, the **Setup** LED stops blinking, and the ABR beeps once.

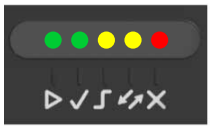
4.4 Learn

Once entered, the imager starts a procedure to automatically detect and recognize a single code [17] which is presented to it. Successive Learns will substitute the current code. To configure multiple codes, use the Barcode Manager Auto-learn procedure.

Exit **Learn** mode at any time by pressing the Smart Teach button once. After a short delay the Learn procedure is cancelled.

1. Enter **Learn** mode by pressing and holding the Smart Teach button until the **Learn** LED is on.

Figure 36. Smart Teach Interface: Learn Mode



2. Release the button to enter **Learn** mode.

   The **Learn** LED blinks until the procedure is complete. The Learn procedure ends when the Image Processing and Decoding parameters **for a single code** are successfully saved in the reader memory, the Green Spot is activated, the **Learn** LED stops blinking, the ABR beeps once, and exits **Learn** mode.

Note: The PPI (Pixels Per Inch) Setup Chart cannot be used to set the Code 128 symbology (even though the reader successfully reads the code). Use the application-specific code if you need to set this symbology.

Note: If you have used this procedure to configure the ABR, go to .

[17] The Learn procedure does not recognize the following symbologies: Postal Codes, Pharmacode, and MSI. Configure through Barcode Manager for these codes.

5 Getting Started

Power up the sensor, and verify that the power LED is on blue. Ethernet models only: verify that the Ethernet indicator is on amber to verify the Ethernet connection.

5.1 Install Barcode Manager

Administrative rights are required to install the Barcode Manager software.

Important: Install Barcode Manager on a Windows® 7, 8, or 10 [18] computer. Barcode Manager does not currently support Windows Embedded (often used in industrial PCs and/or PLCs).

1. Download the latest version of Barcode Manager from www.bannerengineering.com.
2. Navigate to and open the downloaded file.
3. Run the downloaded file to access the installation screen.
4. Follow the onscreen installation procedure.
   After the installation is complete, the Barcode Manager entry is created under **Start** > **Programs** > **Banner Engineering**. A desktop icon is also created.

5.1.1 Connect to Barcode Manager

Depending on your ABR 3000 model, connect to the Barcode Manager configuration environment through one of the following interfaces:

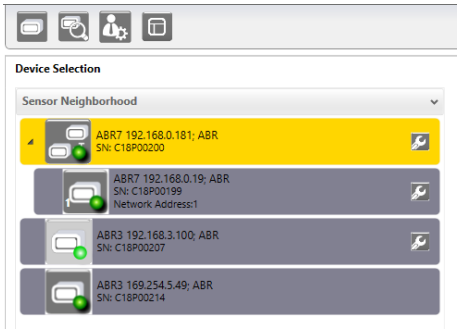
- Ethernet Configuration— Ethernet Device Discovery on p. 30
- USB Configuration— USB Device Discovery on p. 31
- Serial Configuration [19]— Serial Device Discovery on p. 32

5.2 Ethernet Device Discovery

The following configuration procedure assumes that a laptop computer running Barcode Manager is connected to a factory default reader through the Ethernet port.

The Barcode Manager user interface opens and displays a list of all the devices belonging to the Local Area Network (LAN).

Figure 37. Device Discovery



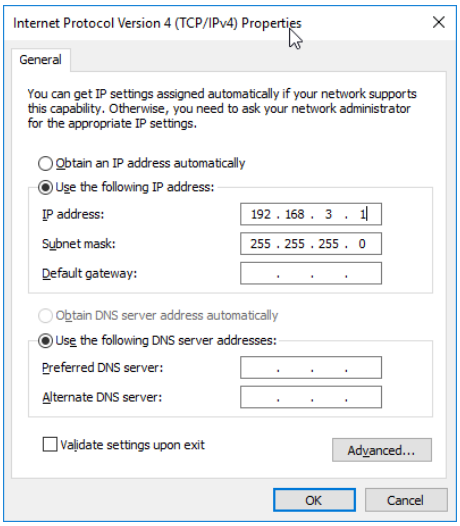
The Barcode Manager discovery feature also shows devices not belonging to the LAN and displays them in light gray (see Figure 37 on p. 30).

The following is an example configuration for Windows® operating system version 7, 8, or 10.

1. Confirm the network connections. Changing the Local Area Connection (LAN) properties of the programming computer to be compatible with the ABR device on the network may be required for connection.
   a) Click the **Start** button, then on the **Start** menu, click **Control Panel** or search for **Control Panel**.
   b) In **Control Panel**, click **Network and Internet**, then click **Network and Sharing Center**, and then click **Change adapter settings**.
   c) Right-click on the connection that you want to change, then click **Properties**.
      If you are prompted for an administrator password or confirmation, enter the password or provide confirmation.
   d) In the connection properties, click **Internet Protocol Version 4 (TCP/IPv4)**, and then click **Properties**.

[18] Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.
[19] All devices can be configured through their Main Serial port. However, through this interface, configuration is slower than the Ethernet or USB interfaces and presents some limitations. It is recommended to use the Serial interface for configuration only if the other interfaces are not available.

Figure 38. Local Area Connection Properties



e) In the **Internet Protocol (TCP/IPv4) Properties**, select **Use the following IP address**.
f) Make sure that the IP address is 192.168.3.1, and the subnet mask is 255.255.255.0.
The IP address must be compatible with the default device address 192.168.3.100.

2. As an alternate method, change the IP address of the device.
a) Add the device to the LAN by aligning its IP Address to the network. The network administrator should provide valid LAN address(es).
b) Click the **device wrench** icon to open the **Device Environment Configuration** window.
c) Change the Ethernet Settings (IP Address, Subnet Mask, Gateway Address, etc.) according to the network requirements.
d) Click **OK**.

3. In Barcode Manager, click **Find Devices**.
The device displays in **Sensor Neighborhood** with a dark gray icon, meaning it is now part of the LAN and can be configured. The new IP address also displays.

4. Double-click or drag the **device** icon into the **Selected Device Information Area**.
Details about the device display in this area.

Figure 39. Device Selection—Selected Device Details

Selected Device Details	
Name	ABR
Model	ABR3006-WSU2
Layout Type	Alone
Internal Network Role	Slave
Status	Default Running
Startup Info	OK
Application SW Version	1.5.4.645-f273f1
Loader Version	N/D

After device discovery, configure your device through Barcode Manager.

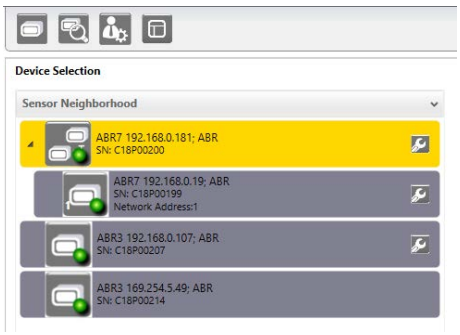
5.3 USB Device Discovery

The following configuration procedure assumes that a laptop computer running Barcode Manager is connected to an ABR 3000 USB model reader through the USB port using cable MQDEC-1703SS-USB or CSB-M121701USB02M121702.

ABR 3000 Ethernet models can also connect by USB. However, they do not show up with this device discovery method. For more information see *ABR 3000 Ethernet Model Connection via USB* available at www.bannerengineering.com.

1. After the reader is connected to the USB port and successfully starts, from Barcode Manager, click **Getting Started** to discover the reader.
The reader is shown in the **Sensor Neighborhood** list.

*Figure 40. **Sensor Neighborhood** List*



2. Find your reader in the list by matching its serial number (SN). The USB driver creates a virtual Ethernet connection with an IP address that cannot be modified.

Tip: The USB unit is the one in the **Sensor Neighborhood** list without a **wrench** icon (used for modifying the IP parameters).

3. Double-click on or drag the **device** icon into the **Selected Device Information Area**. Details about the device display in this area.

Figure 41. Device Selection—Selected Device Details

Selected Device Details	
Name	ABR
Model	ABR3006-WSU2
Layout Type	Alone
Internal Network Role	Slave
Status	Default Running
Startup Info	OK
Application SW Version	1.5.4.645-f273f1
Loader Version	N/D

Note: After device discovery, configure your device through Barcode Manager as described in Device Configuration on p. 34.

5.4 Serial Device Discovery

Note: Although this feature allows all devices to be configured through their Serial Interface, be aware that transmission speeds and some Barcode Manager features are limited when using this interface. It is advised to use the Ethernet or USB interface whenever possible.

Serial Device Discovery is not enabled by default.

1. In Barcode Manager, from the main menu go to **Options** > **UI Settings** window.
2. Click on the **Global Settings** menu and scroll down to the **Find Devices** section.
3. Select **Enable Serial Device Discovery**.
   Additional options become available, including **Serial Parity**, **Serial Databits**, **Serial Stop Bits**, and **Baud Rates**.
4. Scroll down to see the options.
5. Select the Serial communication parameters according to your application.
   The default is 115200.

Note: If you're not sure of the Serial baud rate, select **Enable Automatic Device Discovery** which for serial devices will try communication at all baud rates, but only at No parity, 8 data bits;1 stop bit.

Enabling this parameter can notably lengthen discovery time. In general it is better to disable it to increase discovery efficiency.

6. Click **OK** to return to Barcode Manager.
7. Click the **Getting Started** icon.
8. Open the **Serial Devices** tab.

9. Drag the  **device** icon into the **Selected Device Information** area.
   The device is now connected to the Barcode Manager Configuration environment. Configure your device through Barcode Manager.

6 Device Configuration

6.1 Automatic Setup

To begin configuration, the reader must be correctly mounted at the correct reading distance for your application so that its Field of View covers the application reading area.

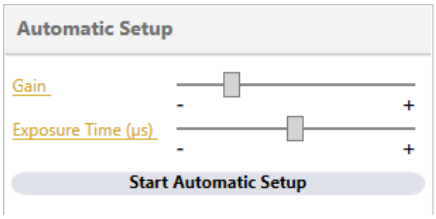
Automatic Setup provides an automatic procedure for setting optical/illumination and code definition parameters to obtain the most stable decoding conditions for a single code symbology based on the images presented to the reader. It can be set to include Image Filters if necessary. See the table below for codes and filters managed by Automatic Setup.

Enabled 1D Codes		Enabled 2D Codes	Enabled Filters
Code 128	GS1 DataBar Stacked	Data Matrix ECC 200	Erode 3×3, 5×5 and 7×7
EAN 128	GS1 DataBar Limited	QR	Dilate 3×3, 5×5 and 7×7
Code 39	GS1 DataBar Expanded	Micro QR	Smoothing
Code 93	GS1 DataBar Expanded Stacked	Aztec	
Codabar	UPCEAN Family EAN13	MAXICODE	
PDF417	UPCEAN Family EAN8	DOTCODE	
MICRO PDF417	UPCEAN Family UPCA		
GS1 DataBar	UPCEAN Family UPCE		

1. Click **Open Device Configuration**. The **Open Device Configuration** window opens showing the list of configurations (jobs) currently saved on the device. For new devices, the only saved configuration is the Default configuration.
2. Click **OK**. The device enters Live Image Capture mode and begins acquiring images.
3. Place the application code in front of the reader at the correct application reading distance.
4. If needed, set the focus manually. See Set the Focus on p. 9.
5. After the code is positioned, click **Pause** to stop image acquisition.

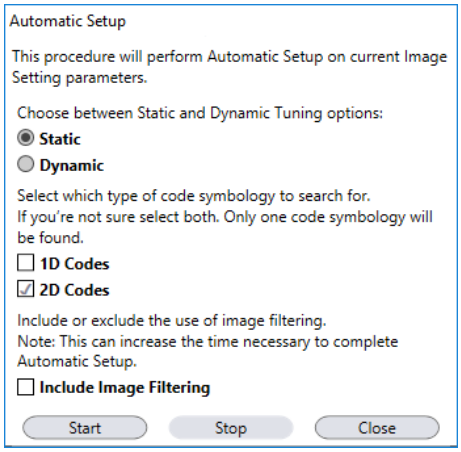
Note: If the image display area is too dark to see the images being captured, drag the Gain and Exposure Time sliders to the right to increase visibility. This will not affect Automatic Setup.

Figure 42. Gain and Exposure Time



6. Click **Start Automatic Setup**. The **Automatic Setup** window opens.

Figure 43. Automatic Setup



7. Select the correct reading conditions.
   - **Static** Tuning—No maximum limit on exposure time
   - **Dynamic** Tuning—Maximum allowable image exposure is automatically calculated using the parameters
   - **1D** code
   - **2D** code
   - **Include Image Filtering**—Select to find the best decoding condition.
8. Click **Start**.

   The reader begins acquiring images and adjusting the brightness and decoding settings to find a barcode and optimize reading for the first code it finds. At the end of the procedure the Status: Completed message displays.
9. Close the **Automatic Setup** window.

   Your reader is now optimized for decoding. Continue setting up the reader for your application as desired. Typically, **Reading Phase** is configured next. See Reading Phase on p. 37.

6.2 Advanced Setup for Manual Adjustable Focus Models

Advanced Setup provides access to the complete array of optical/illumination and code definition parameters that can be fine-tuned semi-automatically and manually to obtain the best results for applications of any complexity. If your application requires multiple code symbologies, multiple image settings, Code Grading, or other parameter settings for decoding, use the Advanced Setup.

To begin configuration, correctly mount the sensor at the correct reading distance for your application so that its Field of View (FOV) covers the application reading area.

1. From the **Task Area** select **Open Device Configuration**.
   The **Open Device Configuration** window opens showing the list of currently saved configurations (jobs) saved on the device. For new devices, the only saved job is the Default configuration.
2. Click **OK**.
   The device enters run mode and begins acquiring images.
3. Place an application-specific code in front of the reader at the correct application reading distance.
4. Using a 2.5 mm hex key (Allen wrench), rotate the Focus Adjustment Screw at the back of the reader to one of the factory calibrated positions for your application.

   The factory calibrated positions are: 45, 70, and 125 mm for WVGA models; 45, 80, and 125 mm for MP models.

   CAUTION: Do not rotate the Focus Adjustment Screw beyond the focus scale limits or damage can occur to the focus mechanism.

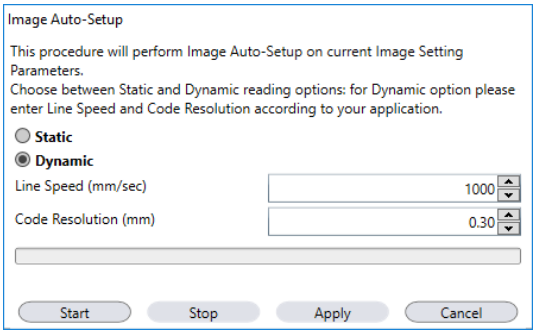
   Refer to Reading Diagrams on p. 100, which shows the reading ranges at the different focus positions for Code 128 (1D) and Data Matrix (2D) codes.
5. After the application-specific code is positioned, click **Pause** to stop image acquisition.

Figure 44. Advanced Setup—Application-Specific Code



6. Click **Image Settings**, and then click **Image Auto-Setup** **Image Auto Setup** to automatically acquire the best exposure time and gain values.
7. Select the reading option.
   - **Static**—No maximum limit on exposure time
   - **Dynamic** reading—Maximum allowable image exposure is automatically calculated using the parameters
8. Click **Start**.
9. Click **Apply**.

Figure 45. Image Auto-Setup

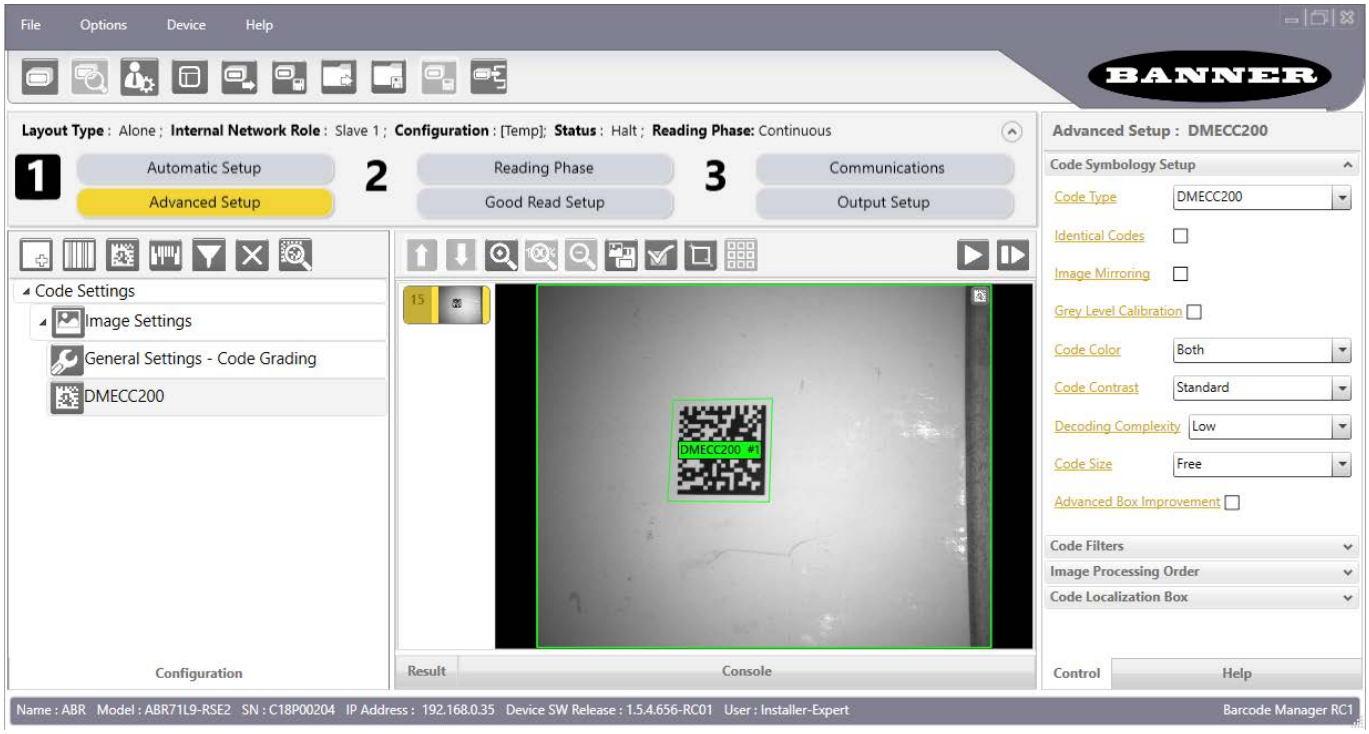


Note: For applications having multiple lighting or code reading conditions, up to 10 different Image Settings can be configured by adding them with the icon.

10. Click on the **Data Matrix ECC 200** symbology under the **Image Settings** branch (enabled by default).

    If this symbology is among those in your application it will be shown in the image display with its code symbology name. A small green box around it indicates it is decoded.

Figure 46. Decoded Symbology



Note: The large green box for each symbol indicates the code localization area which by default is equal to the maximum FOV. Resize and move the box by dragging the borders with the mouse. The code must be found within this area in order to be decoded.

11. Add application-specific codes to the **Code Settings** by selecting them from the icons over the **Configuration Parameters** tree area.
12. If the Data Matrix symbology is not used, delete it from the **Code Settings** with the icon.
    If you don't know the code type, use the Code Autolearn [20] feature by clicking the icon. See the Barcode Manager Instruction Manual for details.
13. For each code symbology set the relative parameters according to your application.

6.3 Reading Phase

1. Click Reading Phase **Reading Phase**.
2. Select your application-specific Operating Mode from the icons over the Configuration Parameters tree area:
   - Continuous
   - One Shot
   - Phase Mode

   Continuous Mode and **Acquisition Trigger** are shown by default.
3. Configure the relative **Operating Mode** parameters from the **Reading Phase** Control panel.
   Different groups appear in the panel depending on the selected icons over the **Configuration Parameters** tree area.

6.4 Good Read Setup

1. Click Good Read Setup **Good Read Setup**.
2. Select your specific data collection type from the icons over the Configuration Parameters tree area:
   - Code Collection

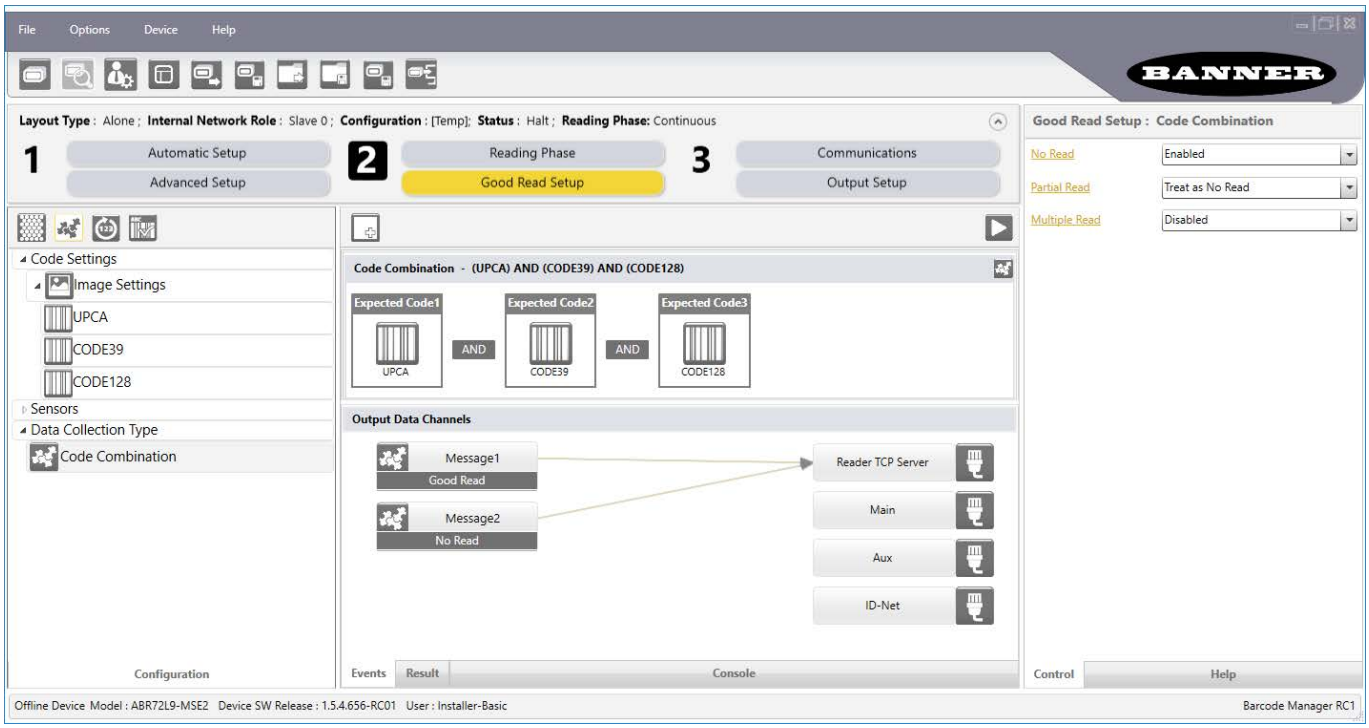
[20] The Code Autolearn procedure will not recognize the following symbologies: Pharmacode, MSI, Standard 2 of 5, Matrix 2 of 5.

- Code Combination
- Code Presentation
- Match Code

Not all data collection types are available for all Operating Modes. Incompatible data collection types are shown in gray and cannot be selected.

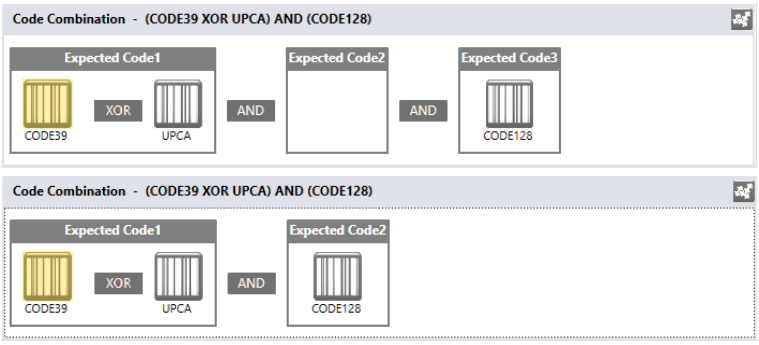
The following example shows **Code Combination**. By default, the Expected Codes (when more than one code type is selected), are in logical AND, which means that all codes are required to be decoded to produce a Good Read condition.

Figure 47. Good Read Setup: Code Combination



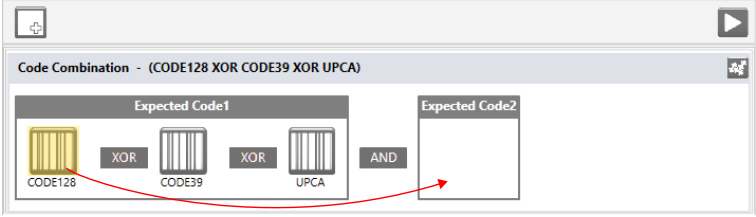
3. If a Good Read condition should be produced when any single code is decoded, independent from the others, combine them in logical XOR.
   a) Drag the code icon(s) from their relative Expected Code box into the Expected Code box of the XOR combination you wish to create.
   b) Delete the empty box by selecting it with the mouse (highlighted) and pressing **delete** on your keyboard.

Figure 48. Code Combination



   c) To create a logical AND condition from a logical XOR, create a new Expected Code box using the icon.
   d) Drag the desired code icon from one box to the other.

Figure 49. New Expected Code

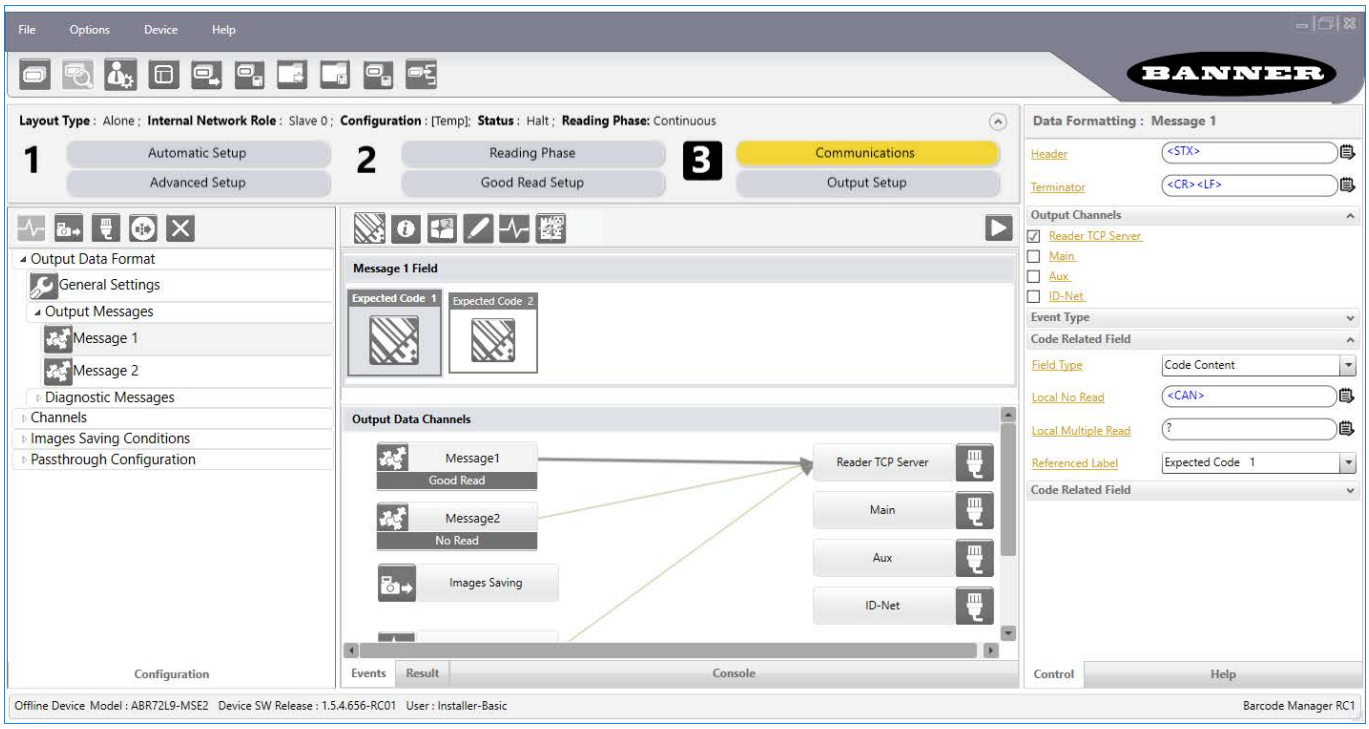


6.5 Communications

For details, see the Barcode Manager Instruction Manual, available at www.bannerengineering.com.

1. Click **Communications**.
2. Configure your application-specific Output Data Message(s) from the Configuration Parameters tree area: Message 1, Message 2, etc.

Figure 50. Communications



3. Add fields to the output message by clicking on the icons above the Message Field area.
   The fields are appended to the message.
4. Drag the fields to position them between other fields in the message so that the output message is ordered according to your application requirements.

   Each field has its own relative configuration parameters in the Control panel.

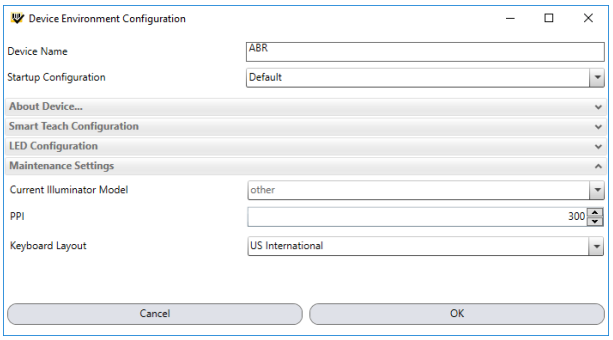
6.5.1 USB-HID (Keyboard Wedge) Configurations

The ABR 3000 USB interface allows the reader to be used as a USB-HID device (virtual keyboard) otherwise known as a keyboard wedge.

In this configuration, code reading input from the ABR is sent directly to the application running on the PC as if it was typed from the PC keyboard. This is typically used in data entry programs.

To assure the input is correctly interpreted, the ABR reader must be aligned with the keyboard type. This is done through **Device** > **Settings** > **Settings** > **Maintenance Settings**. Select your keyboard from the dropdown list.

Figure 51. Device Environment Configuration

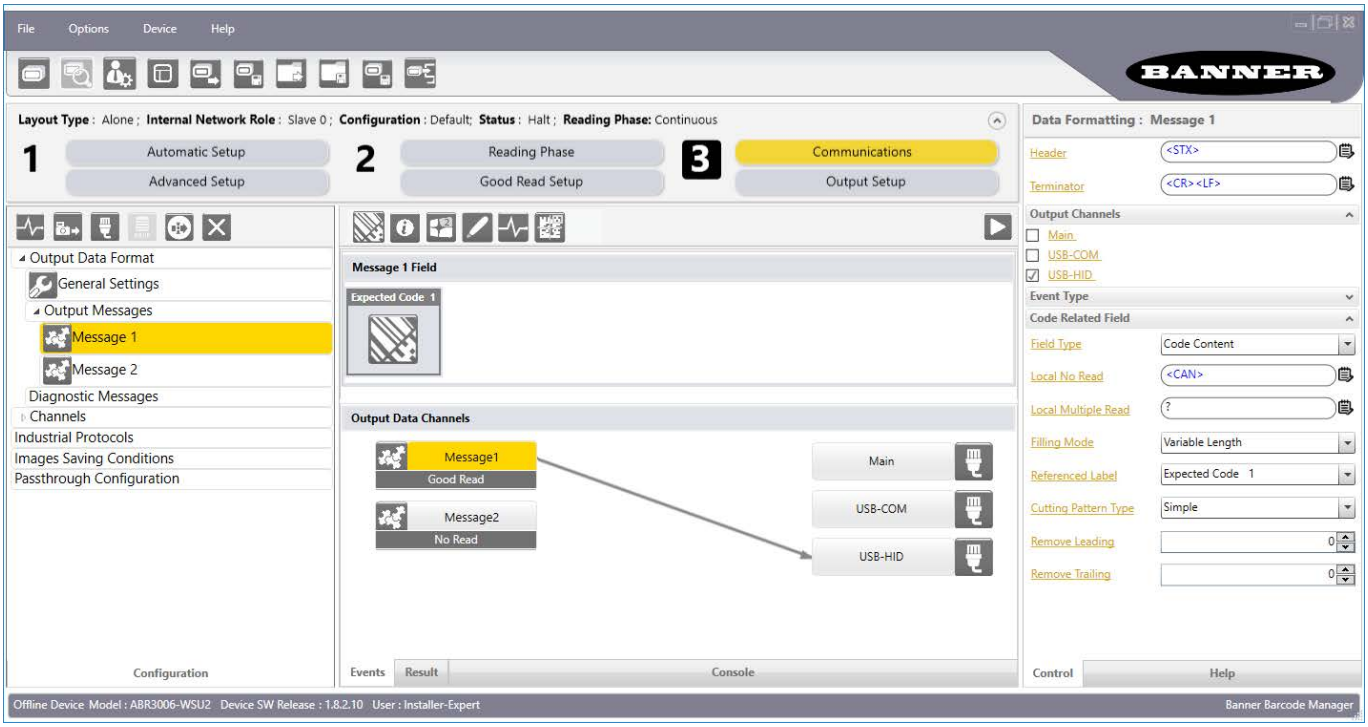


The USB-HID interface is an ABR Output only channel and is configured through the **Communications** page.

Correctly set the Header and Terminator parameters depending on the requirements of the application running on the PC.

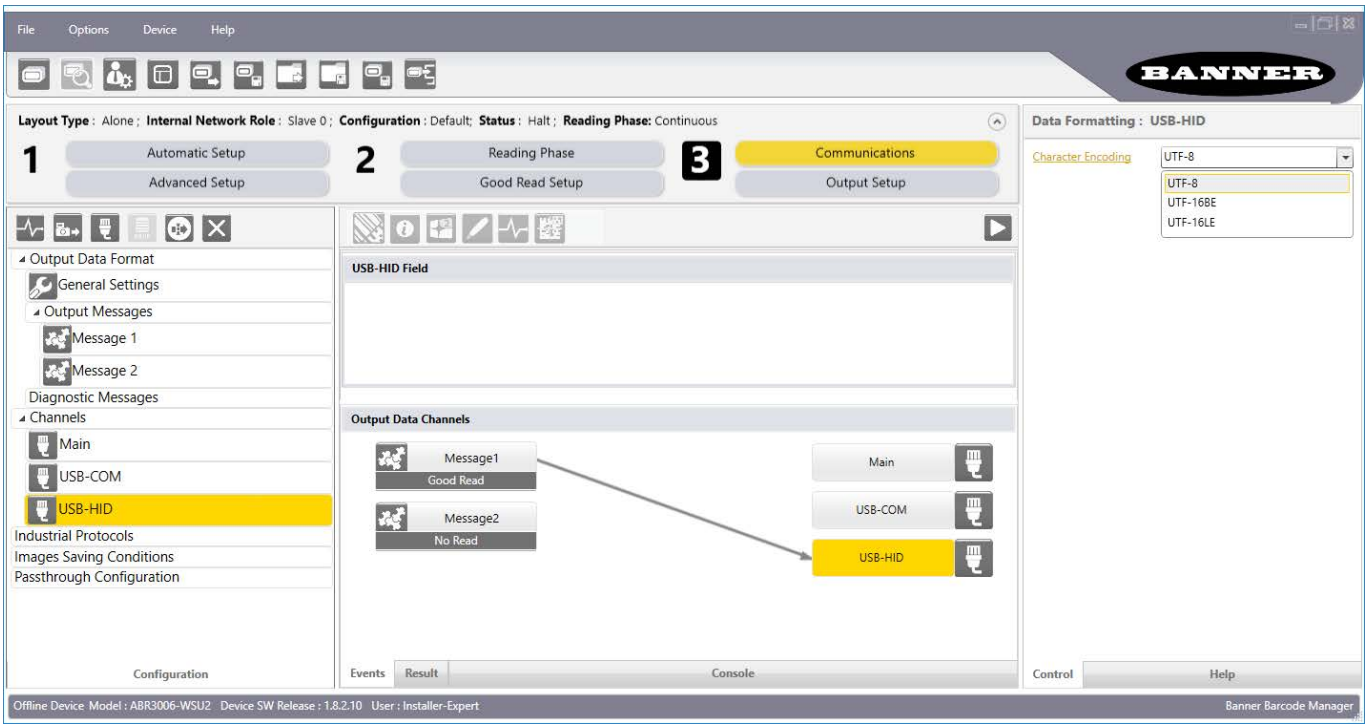
Typically, the Good Read message is transmitted, the No Read message is not transmitted, and Multiple Reads need to be correctly managed.

Figure 52. Communications—Output Channels



Data can be sent using different character encoding selections according to your application needs.

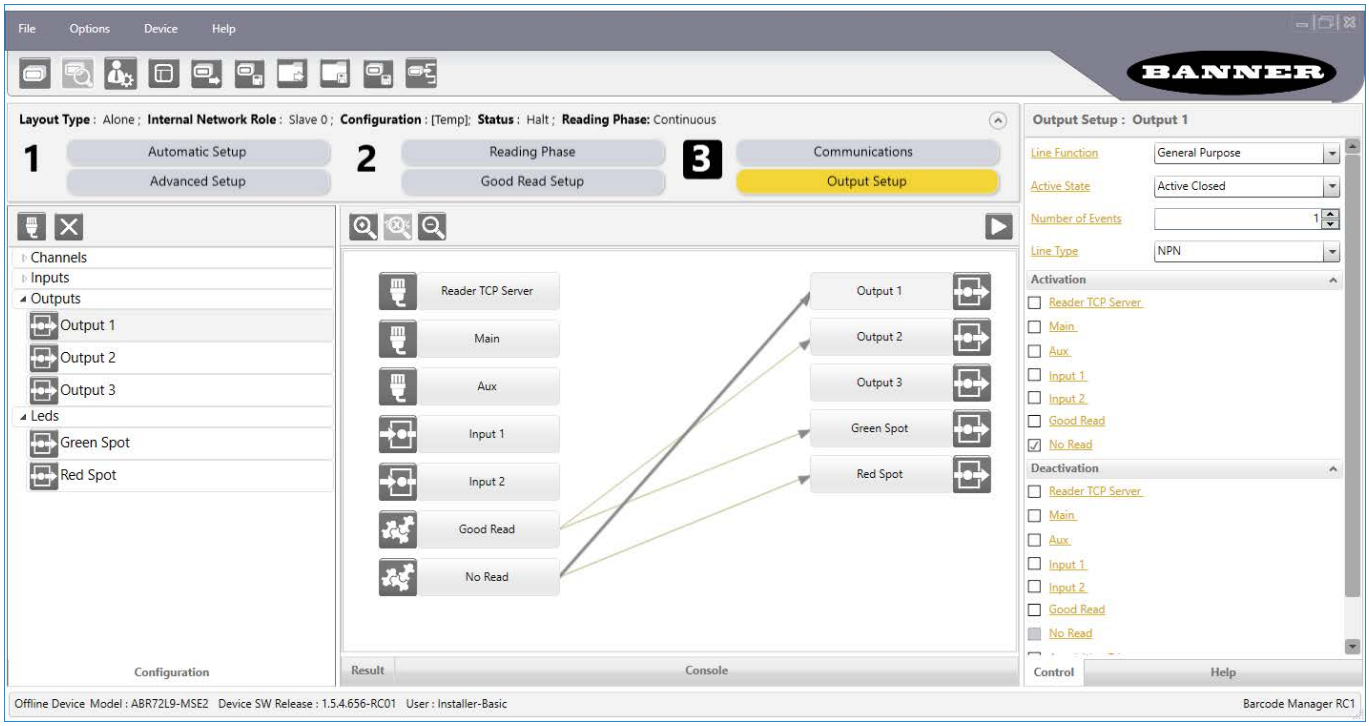
Figure 53. Communications—USB-HID



6.6 Output Setup

1. Configure your application-specific Digital Output(s) and Green/Red Spots (if used) from the Configuration Parameters tree area: Output 1, Output 2, etc.

Figure 54. Output Setup



2. Save the configuration from temporary memory to permanent memory, overwriting the previously saved configuration.

6.7 Fine-Tuning Examples

The following examples show some of the typical conditions occurring during the installation and how they can be tuned manually.

6.7.1 Under-Exposure

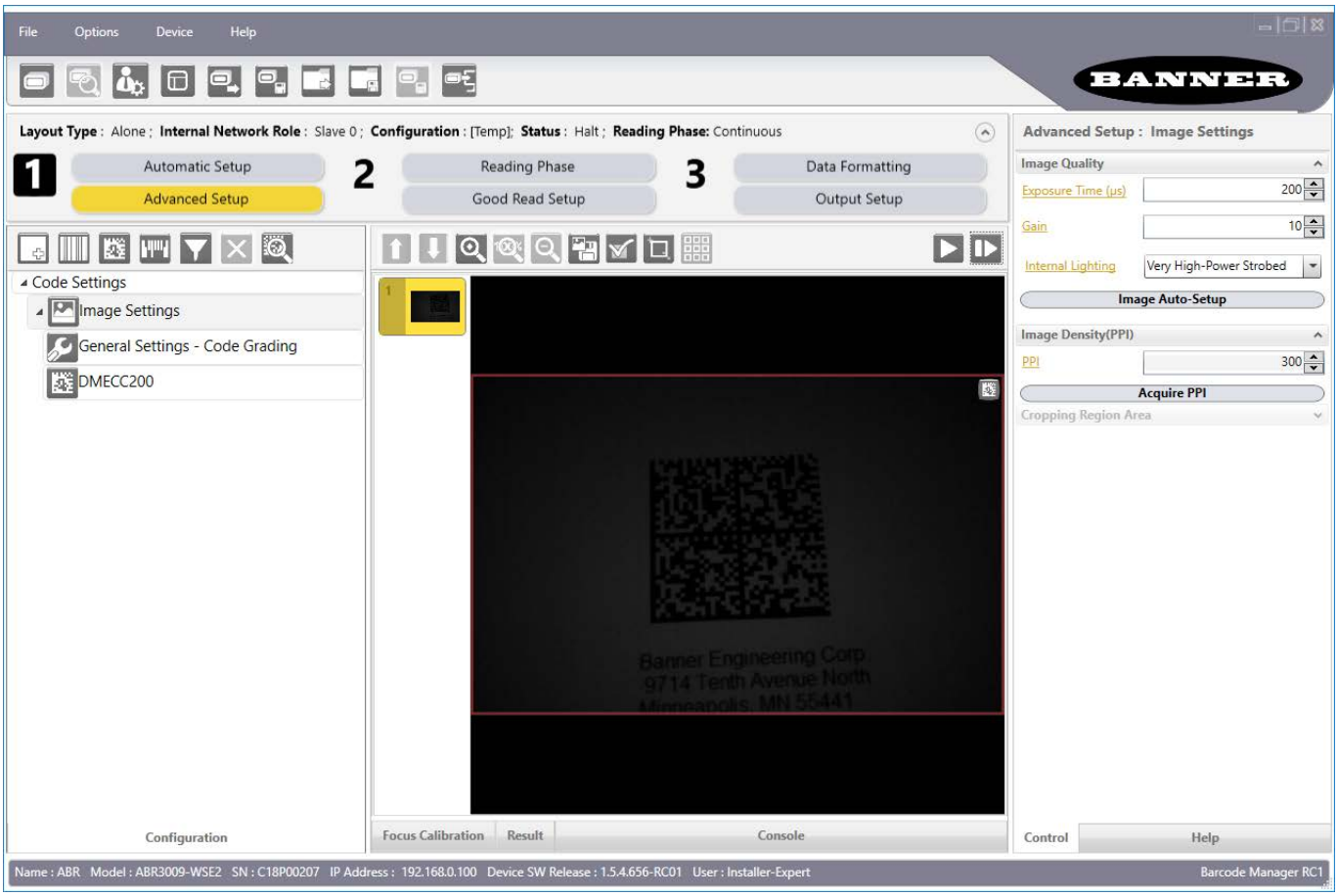
To correct an under-exposure result it is recommended to change the following parameters in their order of appearance:

1. Increase the Exposure Time.
2. Increase the Gain.

Note: In general, a longer exposure time corresponds to a lighter image but is susceptible to blurring due to code movement.

High gain settings may produce a grainy image that may affect the decoding process.

Figure 55. Example Under Exposure: Too Dark

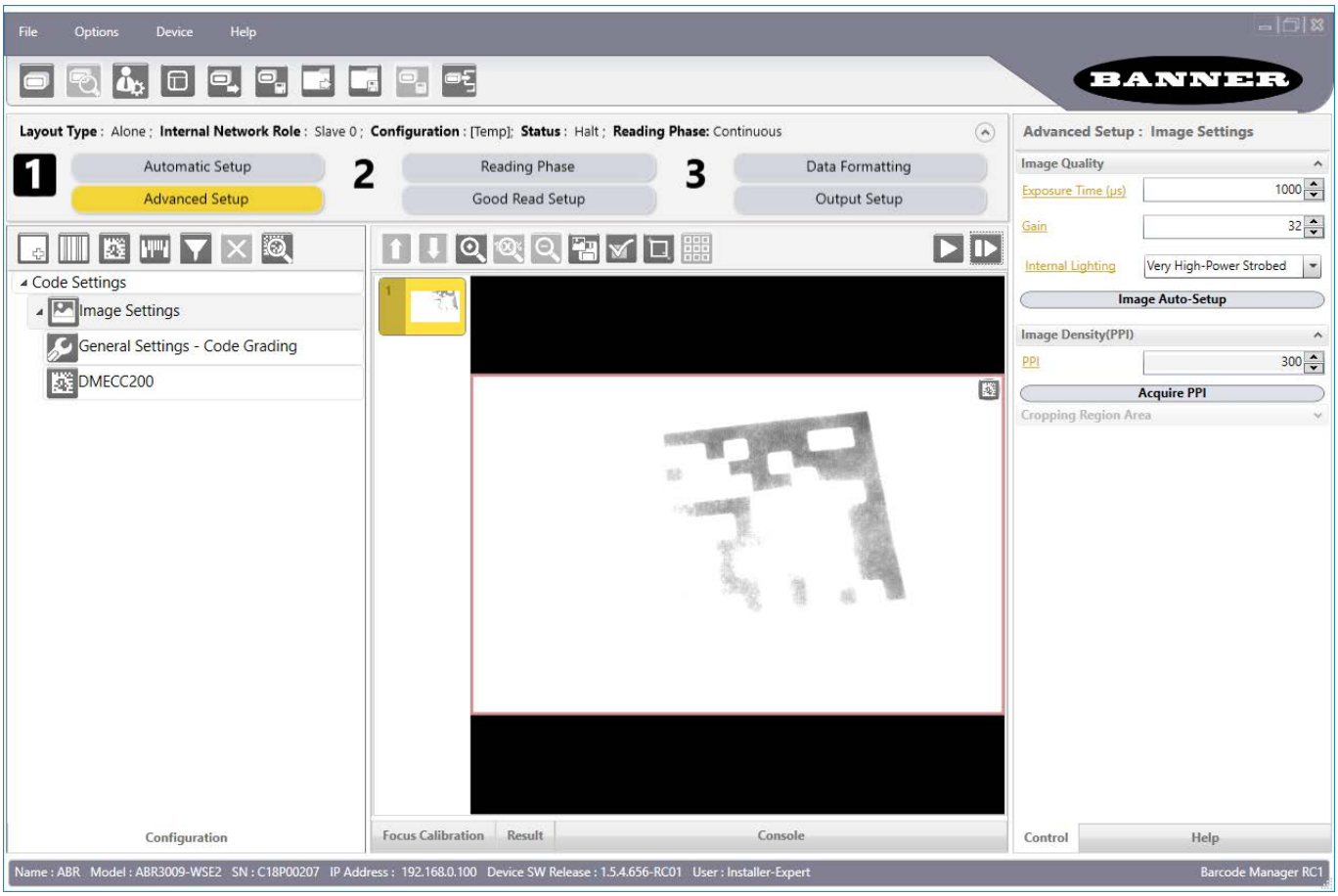


6.7.2 Over-Exposure

To correct an over-exposure result, change the following parameters in order:

1. Decrease the Gain.
2. Decrease the Exposure Time.

Figure 56. Example Over Exposure: Too Light



6.7.3 Code Moving Out of the FOV

To correct code moving out of the FOV and have the code completely visible in FOV, follow one or both of the following options:

- Reposition the reader
- Use the Delay on Trigger and set the Time or Space values

Figure 57. Example of Code out of the FOV

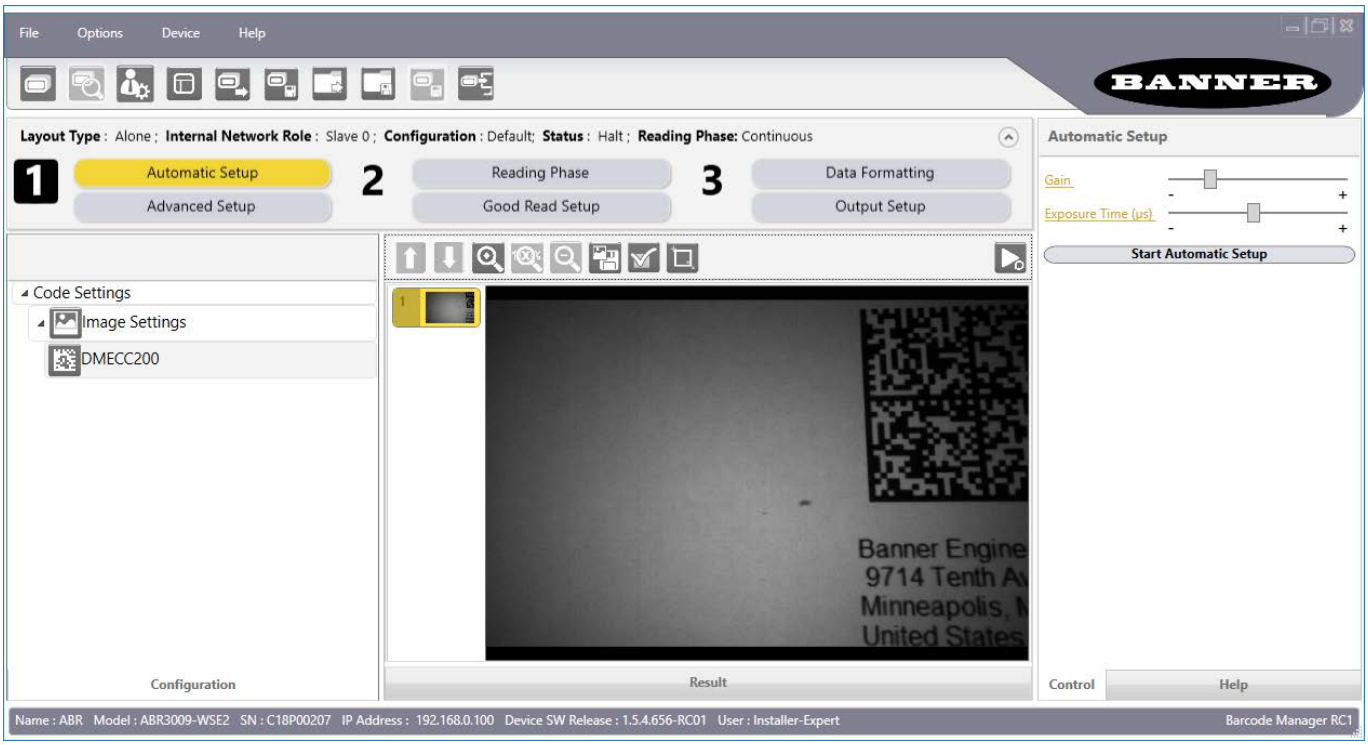
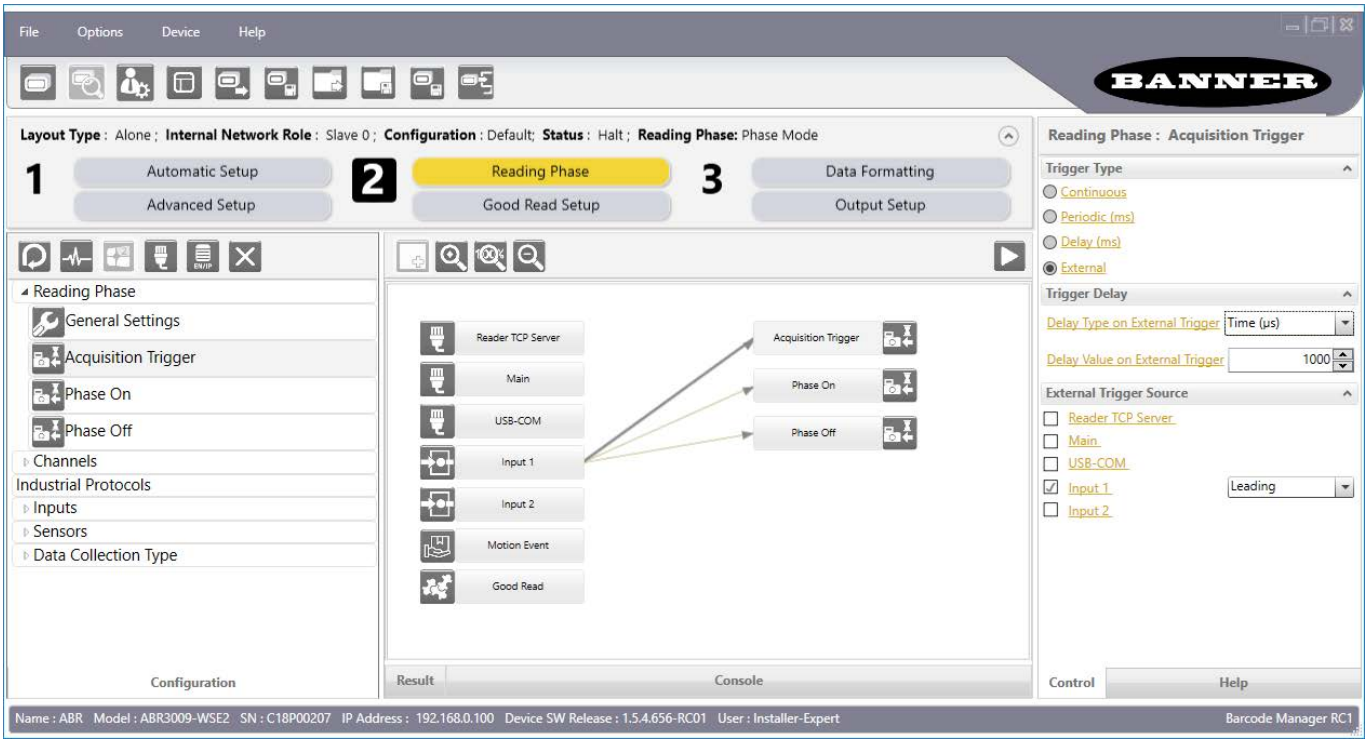


Figure 58. Add Delay on Trigger to Correct Out of FOV



7 Advanced Reader Configuration

For further details on advanced product configuration, refer to the Barcode Manager Instruction Manual available in the Barcode Manager Help menu.

7.1 Host Mode Programming

The reader can also be remotely configured from a host system using the Host Mode programming command language. See the Host Mode Programming information in the Barcode Manager Software Instruction Manual, available at www.bannerengineering.com.

8 Industrial Ethernet Overview

The ABR reader is compatible with and can be monitored and controlled using Industrial Ethernet protocols (EtherNet/IP™ [21], MODBUS® TCP [22], SLMP, or PROFINET® [23]). On the monitoring side, the ABR makes the barcode data output string configured on the Communications page available to a PLC or HMI along with eight user-defined output bits. These output bits can be configured to report the current status of the ABR, including Good Read, No Read, etc. or to report the status of an input bit.

Control of the ABR using Industrial Ethernet is possible using eight user-defined input bits. These can be configured as Reading Phase On, Reading Phase Off, Acquisition Trigger, or they can control an output bit.

Input command strings cannot be sent to the ABR using Industrial Ethernet, but trigger and Host Mode Programming commands can be sent to the TCP server channel by a socket connection.

8.1 Industrial Ethernet Setup in Barcode Manager

8.1.1 Set the Compatible Industrial Ethernet Protocol (EtherNet/IP™, MODBUS® TCP, SLMP, PROFINET®)

The Industrial Ethernet communication channel is disabled by default.

To enable this channel, use the following instructions.

1. From the **Reading Phase**, **Communications**, or **Output Setup** pages, click **Add New Industrial Protocol**.

   Note: This option is available only for **Installer-Expert** users.

2. Select one of the choices:
   - EtherNet/IP
   - MODBUS TCP Client
   - MODBUS TCP Server
   - SLMP
   - PROFINET [25]
3. After changing the settings, click **Play**, **Monitor**, or **Getting Started** to activate Industrial Communications with the new settings.

8.1.2 Industrial Ethernet Reading Phase Control

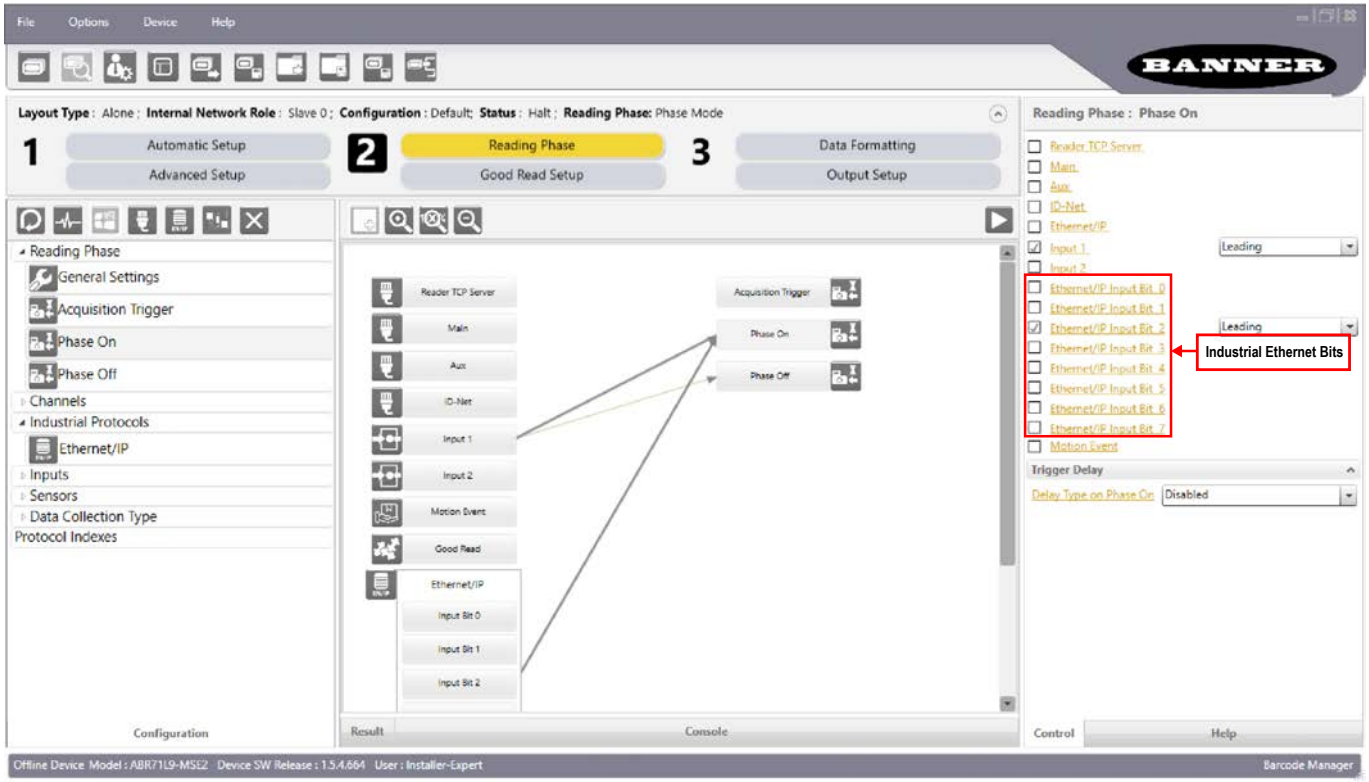
The Industrial Ethernet host controller can control the reading phase by assigning individual communication bits to reading phase parameters. These bits are received on the Industrial Ethernet channel as Input Bits.

To control the reading phase start and end using Industrial Protocol Input Bits, use the following instructions:

1. Go to **Reading Phase** > **Phase Mode** > **Phase On** and select an input bit from the Industrial Protocol Input Bit list.
   In this example, select Bit 2.

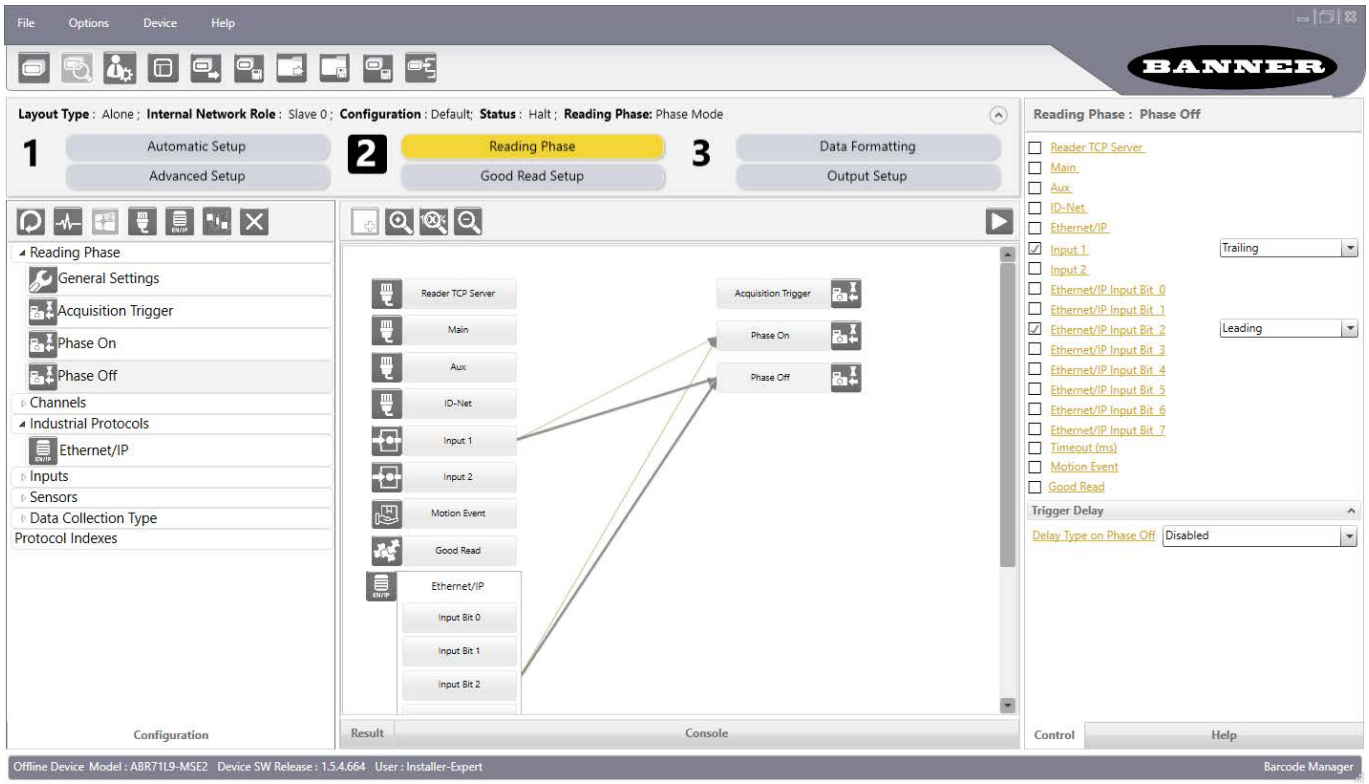
[21] EtherNet/IP™ is a trademark of ODVA, Inc.
[22] MODBUS® is a registered trademark of Schneider Electric USA, Inc.
[23] PROFINET® is a registered trademark of PROFIBUS Nutzerorganisation e.V.
[25] The ABR is PROFINET compatible but not PROFINET certified.

Figure 59. Industrial Ethernet Input Bits Configured for Phase On Control



2. Click **Phase Off**, and select the same bit used in step 1 from the Industrial Protocol Input Bit list.
3. Change selected bit polarity from **Leading** to **Trailing**.
   The reading phase will start when the input bit goes high, and end when the input bit goes low.

Figure 60. Industrial Ethernet Input Bits Configured for Phase Off Control

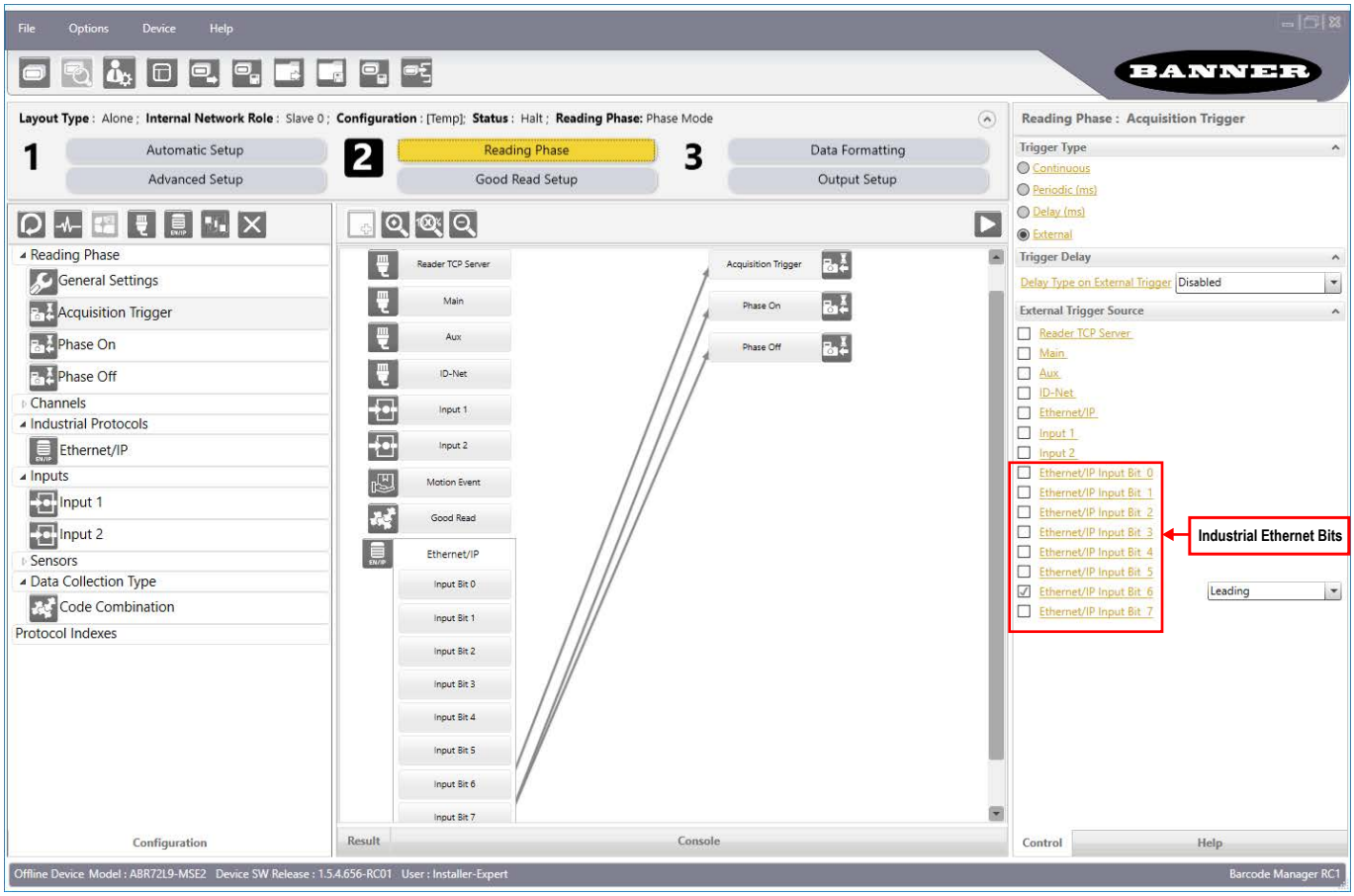


8.1.3 Industrial Ethernet Reading Phase Acquisition Control

To acquire individual images using an Industrial Protocol Input Bit, use the following instructions:

1. Go to **Reading Phase** > **Phase Mode** > **Acquisition Trigger** and select **Trigger Type** as **External**.
   The **External Trigger Source** list displays.
2. Select an Industrial Protocol Input Bit.
   In this example, select Bit 6.
   Because the selected bit polarity is set to **Leading**, the ABR will take an image each time the input bit goes high.

Figure 61. Industrial Ethernet Strings and Bits

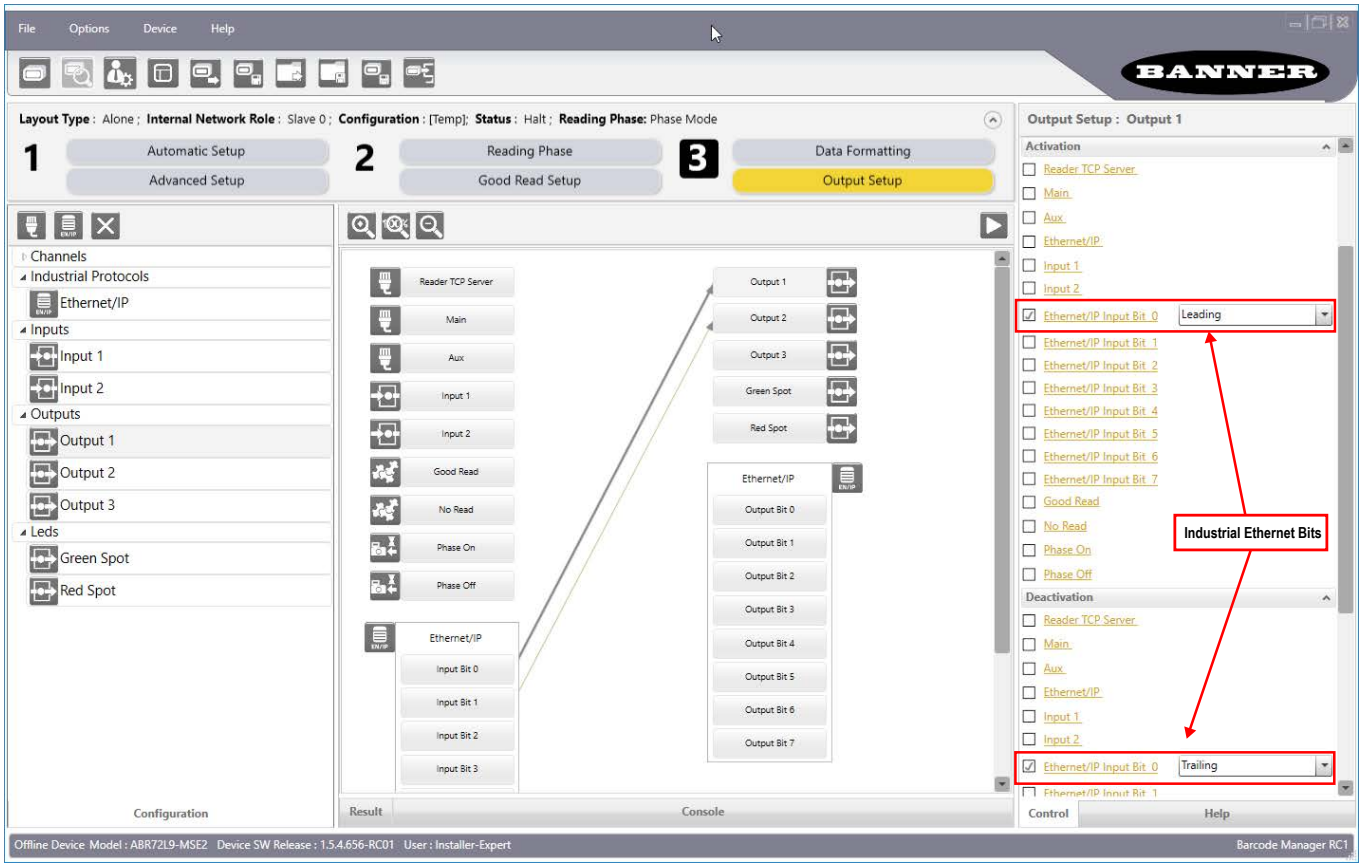


8.1.4 Industrial Ethernet Digital Output Control

The Industrial Ethernet host controller can also drive the ABR reader's physical discrete outputs by assigning individual communication bits to the Digital Output Activation and Deactivation parameters. These bits are received by the ABR as Input Bits.

1. Go to **Output Setup** > **Output**.
2. Under **Activation**, select an input bit, leaving the polarity setting as **Leading**.
   In this example, select **Input Bit 0**.
3. Under **Deactivation**, select the same bit and set it to **Trailing**.
   When the host turns on the ABR Input Bit, the ABR turns on its physical discrete Output 1.

Figure 62. Industrial Ethernet Strings and Bits



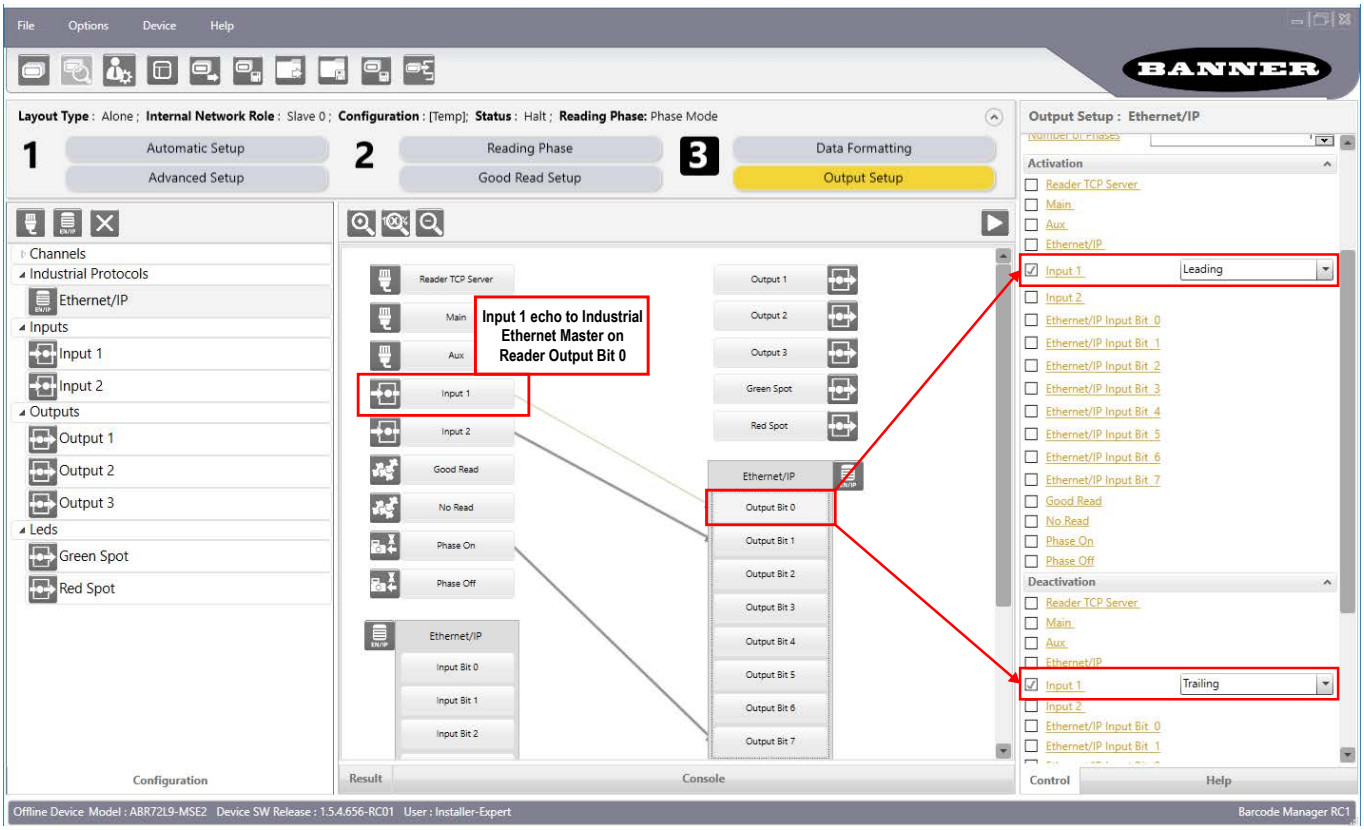
8.1.5 Digital Input Echo to Industrial Ethernet

The Industrial Ethernet host controller can receive echoes of the Reading Phase and discrete digital Input signals from the ABR as Output bits.

1. Go to **Output Setup** and select an Industrial Protocol Output Bit.

   This example uses Output Bit 0.
2. Under Activation, select the discrete digital input to echo, leaving the bit polarity as **Leading**.
3. Under Deactivation, select the same input and set the polarity to **Trailing**.
   When physical Input 1 turns on, the Industrial Ethernet host controller will see the ABR Output Bit 0 turn on.

Figure 63. Digital Input Echo to Industrial Ethernet

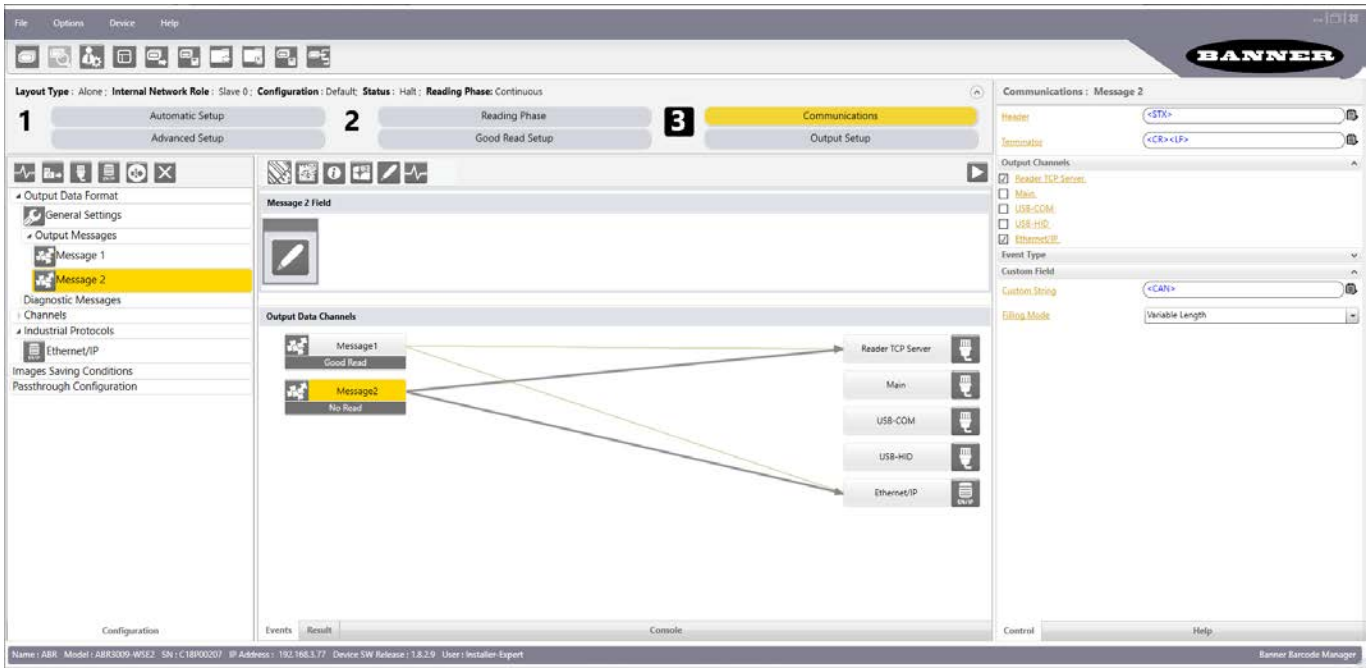


8.1.6 Transmitting Output Data Messages Using Industrial Ethernet

To send the result output data from the ABR to the Industrial Ethernet host controller, use the following steps:

1. Go to **Communications**.
2. Click on the Message you wish to send.
3. Click on the relevant Industrial Protocol.
   In this example, **Message 2** has been linked to the EtherNet/IP Industrial Protocol. The data from Message 2 will be sent, as an ASCII string, to the ABR Industrial Protocol output data registers. Arrows should be drawn automatically from the messages to the Industrial Ethernet channel in the diagram in the center of the screen.

Figure 64. Communications



8.2 EtherNet/IP™

If you are using a PLC programmed by Rockwell Studio 5000 Logix Designer software version 20 or later, such as the ControlLogix or CompactLogix series, you should be able to skip to ABR Series EDS File Installation in Studio 5000 Logix Designer Software on p. 54 and configure your PLC using the EDS and AOI files. The AOI is recommended because when sending messages over EtherNet/IP, the ABR will send one message, and then wait to send any further data until the PLC sends back a handshake value. The AOI performs this handshaking automatically. Users of other controllers may have more need of ABR Assembly Object Descriptions on p. 51 and Configuring the ABR for Ethernet/IP in Barcode Manager on p. 54.

8.2.1 ABR Assembly Object Descriptions

The ABR reader is controlled via EtherNet /IP using assembly objects. From the point of view of a PLC, there is one input assembly and one output assembly

The Originator (client) of the EtherNet /IP connection is the PLC. The Target (AKA server) of the EtherNet /IP connection is the ABR reader. The direction of communication can be described as T > O or O > T (sometimes also shown as T2O or O2T). The following tables list the data contained in all of the ABR assembly instances.

Inputs to the Sensor (Outputs from the PLC)

PLC Assembly Instance 113 (0×71) - 3 Registers (Sensor Inputs/PLC Outputs) O > T

Data transfer direction: Originator (PLC) to Target (ABR). Assembly instance 113 is the data used to control the flow of result message strings from the ABR and pass 8 discrete input bits for control options such as triggering image acquisitions.

WORD#	WORD NAME	DATA TYPE
0	Last Item Sequence Number	8-bit integer
1	Output Bits	8-bit integer
2	Last Fragment Sequence Number	8-bit integer

Last Item Sequence Number

The Last Item Sequence Number is written with the Item Sequence Number by the Originator (PLC) to acknowledge the receipt of the Item Data. If fragmentation is used, this value is not written until the complete message is received.

Output Bits

The Output Bits attribute is a bitmap used to control the state of the eight discrete outputs to the ABR reader.

Last Fragment Sequence Number

The Last Fragment Sequence Number is written with the Fragment Sequence Number by the EtherNet /IP Originator (PLC) to acknowledge the receipt of an individual fragment. If fragmentation is not used, this value does not need to be written.

Outputs from the Sensor (Inputs to the PLC)

PLC Assembly Instance 101 (0×65) - 138 Registers (Sensor Outputs/PLC Inputs) T > O

Data transfer direction: Target (ABR) to Originator (PLC). Assembly instance 101 is the data sent back to the PLC to give the result of the last reading attempt, and the result message string if any.

WORD #	WORD NAME	DATA TYPE
0	Item Sequence Number	8-bit integer
1–2	Item Status	16-bit integer
3–4	Item Data Size	16-bit integer
5	Input Bits	8-bit integer
6	Failure Code	8-bit integer
7	Fragment Sequence Number	8-bit integer
8–9	Fragment Data Size	16-bit integer
10–137	Fragment Data	128 character string

Item Sequence Number

The Item Sequence Number is incremented by one on every new Item Data production. The Item Sequence Number is set to zero at power up. Once an Item Data packet is ready to transmit, the Item Sequence Number is set to one. This number does not increment again until the Originator (PLC) reports that it received the item by putting the matching Item Sequence Number into its Last Item Sequence Number register.

Item Status

The Item Status Code is the status of the last reading attempt and is always updated live regardless of whether the PLC has finished receiving all the fragments of the previous message. The following table shows the status codes and their meanings.

Item Status Code	Item Status Name
0×0000	Good Read
0×0001	Complete, No Read
0×0002	Partial Read
0×0003	Multiple Read
0×0004	Wrong Read

Item Data Size

The Item Data Size is the total size of the Item Data. If the Item Data Size is greater than 128 characters, fragmentation is used (see the fragmentation example in Example of Message Transmissions in Action on p. 53).

Input Bits

The Input Bits attribute is a bitmap used to read the state of the 8 discrete inputs from the ABR reader. These Input Bits are shown as Output Bits in Barcode Manager, and can be configured on the Output Setup page.

Failure Code

The Failure Code is set when an error occurs with the reader. The following is a table of Failure Codes:

Failure Code	Name
0×01	Input Failure
0×02	Communications Failure
0×04	Reader Failure
0×08	Software Error
0×10	Remote Failure

Fragment Sequence Number

The Fragment Sequence Number is set to 1 on the first fragment of the latest Item Data transmission, when the Item Sequence Number increments up by 1. The Fragment Sequence Number is incremented by 1 on every new fragment. If fragmentation is not used, this value is fixed at 1. This value will only increment when the Last Fragment Sequence Number is set to match the current Fragment Sequence Number, to report that the PLC is ready for the next data. The value is only equal to 0 immediately after a power-up, before the first message is sent.

Fragment Data Size

The Fragment Data Size is the length of the data (in bytes) stored in the Fragment Data attribute. If fragmentation is used, this value equals 128 until the last fragment.

Fragment Data

This attribute stores the Fragment Data, which are the output messages from the ABR. If the Item Data Size is less than 128, this attribute stores the complete Item Data. If the Item Data Size is greater than 128, this attribute stores the individual fragments of data.

Example of Message Transmissions in Action

The following is an example of how a PLC receives two Items, one 100 bytes, and the next one 800 bytes, exactly as is done automatically in the I/O Data Add On Instruction (AOI) available on www.bannerengineering.com. The order is the same whether two reading attempts completed in quick succession before the PLC finished reading the first result, or whether they happened with a long period of time in between.

To ABR from PLC		To PLC from ABR					
Last Item Sequence Number	Last Fragment Sequence Number	Item Sequence Number	Fragment Sequence Number	Item Size	Fragment Size	Fragment Data Buffer	Description
0	0	0	0	0	0	NULL	Power Up
		1	1	100	100	[0–99]	ABR sends fragment 1 of item 1
1	0						PLC acknowledges item 1
		2	1	800	128	[0–127]	ABR sends fragment 1 of item 2
1	1						PLC acknowledges fragment 1
		2	2	800	128	[128–255]	ABR sends fragment 2 of item 2
1	2						PLC acknowledges fragment 2
		2	3	800	128	[256–383]	ABR sends fragment 3 of item 2
1	3						PLC acknowledges fragment 3
		2	4	800	128	[384–511]	ABR sends fragment 4 of item 2
1	4						PLC acknowledges fragment 4
		2	5	800	128	[512–639]	ABR sends fragment 5 of item 2
1	5						PLC acknowledges fragment 5
		2	6	800	128	[640–767]	ABR sends fragment 6 of item 2
1	6						PLC acknowledges fragment 6
		2	7	800	32	[768–799]	ABR sends fragment 7 of item 2

To ABR from PLC		To PLC from ABR					
Last Item Sequence Number	Last Fragment Sequence Number	Item Sequence Number	Fragment Sequence Number	Item Size	Fragment Size	Fragment Data Buffer	Description
2	0						PLC acknowledges item 2

Configuration Assembly Object

The ABR EtherNet/IP implementation does not support an assembly object Configuration instance. However, one is required for the creation of implicit Class 1 connections on a ControlLogix® [26] family PLC. Therefore, a configuration instance is defined as instance number 128 (0×80). Its size is zero.

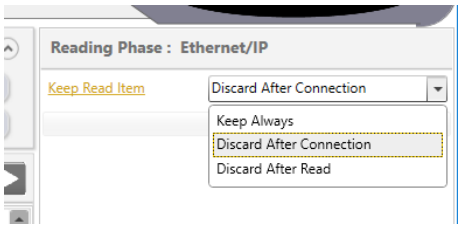
Requested Packet Interval (RPI) Value

The ABR reader can operate with Requested Packet Intervals between 2 and 3200 milliseconds. The default set in the EDS file is 50 milliseconds. Setting this value faster than needed may hurt reading performance. If your message strings are over 128 bytes, it will take multiple packet intervals to transfer the message in 128 byte fragments. At the default 50 milliseconds setting, a 300 byte message string would take 100 milliseconds to 150 milliseconds to transfer completely.

8.2.2 Configuring the ABR for Ethernet/IP™ in Barcode Manager

After Ethernet/IP is added to a configuration's protocols (see Industrial Ethernet Setup in Barcode Manager on p. 46) there is an option to configure settings specific to this protocol. Click **Ethernet/IP** in the left side Configuration panel, and select the desired option under **Keep Read Item** in the right side Control panel.

Figure 65. Keep Read Item



Keep Read Item allows managing the last code read and placed in the output buffer towards the EtherNet/IP host, in cases of re-connections to the network. The default setting will likely work for most applications. The options are:

- **Keep Always**—After the last code in the output buffer is read by the EtherNet/IP server manager (host), it remains in the output buffer.
- **Discard After Connection (default setting)**—After the last code in the output buffer is read by the EtherNet/IP server manager (host), it remains in the output buffer until the connection ends, then it is deleted. In this way it will not be re-read by the same host (or any host) in case of a re-connection.
- **Discard After Read**—After the last code in the output buffer is read by the EtherNet/IP server manager (host), it is deleted from the output buffer. In this way it will not be re-read by the same host (or any host) in case of a re-connection.

When there is more than one code in the output buffer, the EtherNet/IP protocol requires that each code read by the host be deleted and replaced by the next code in the output buffer.

8.2.3 ABR Series EDS File Installation in Studio 5000 Logix Designer Software

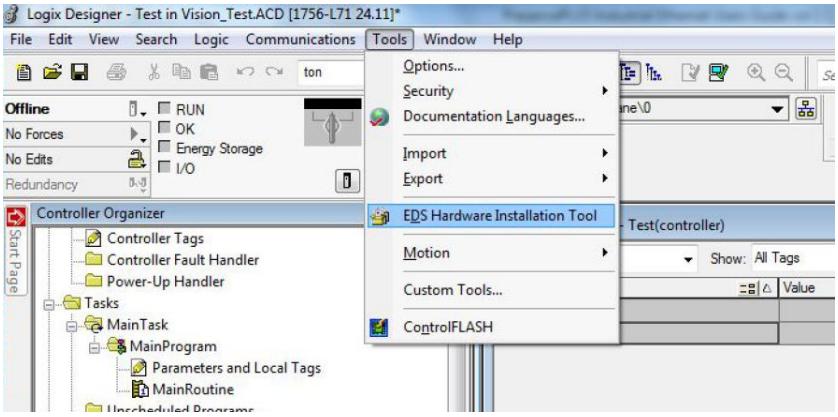
Use the following the steps to quickly and easily establish an implicit Class 1 connection between the ABR and a Rockwell Studio 5000 Logix Designer family PLC.

The screenshots are from an example configuration with a ControlLogix 1756-L71 with a 1756-ENBT/A Ethernet module, using Studio 5000 Logix Designer version 30. Note that ABR Series Manual Installation in Studio 5000 Logix Designer Software on p. 58 may be used instead.

1. Download `Banner_ABR_1_1_08312018.eds` from www.bannergineering.com.
2. On the **Tools** menu, click **EDS Hardware Installation Tool**.
   The **Rockwell Automation's EDS Wizard** dialog displays.

[26] ControlLogix® is a trademark of Rockwell Automation, Inc.

Figure 66. Tools—EDS Hardware Installation Tool



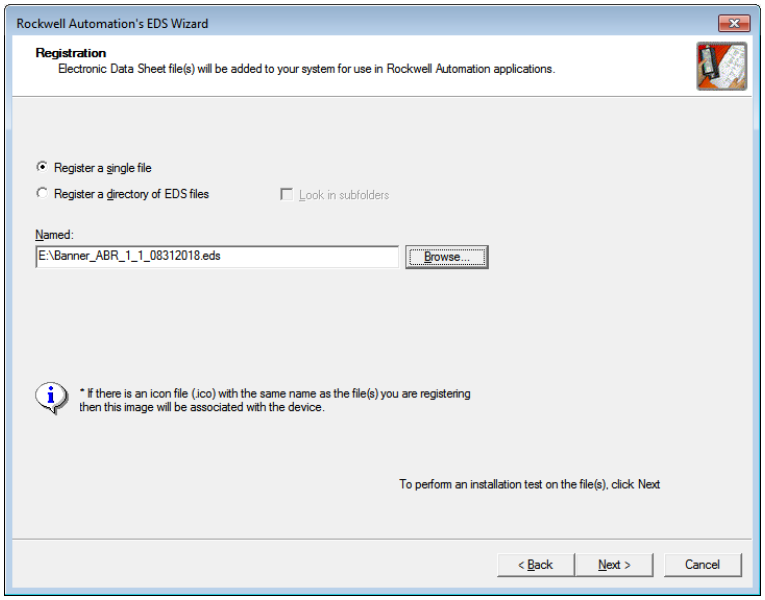
3. Click **Next**.
4. Select **Register an EDS file(s)**.

Figure 67. Rockwell Automation's EDS Wizard—Options



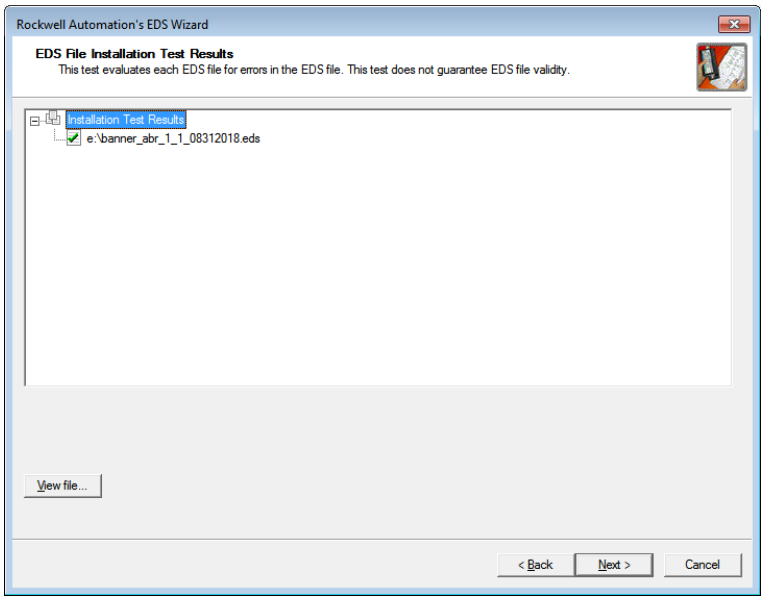
5. Browse to locate the EDS file and click **Next**.

Figure 68. Select File to Register



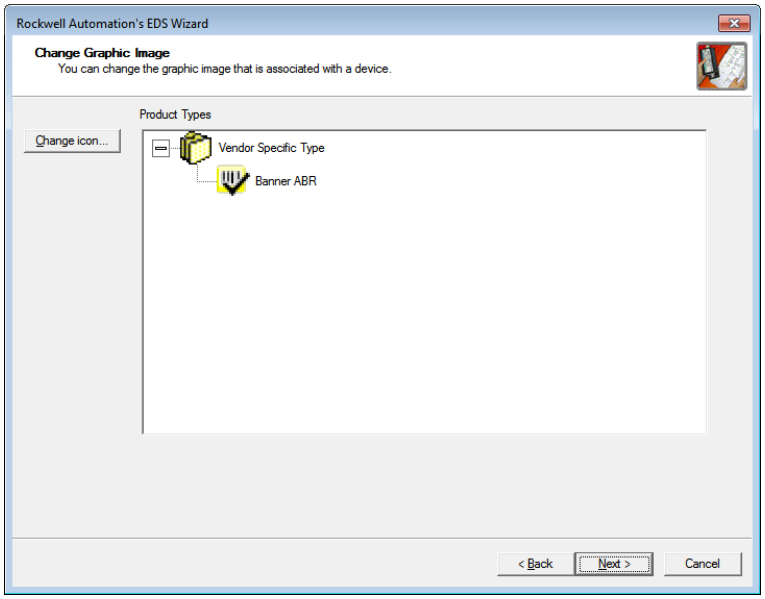
6. Click **Next** to register the tested file.

Figure 69. Register the Tested File



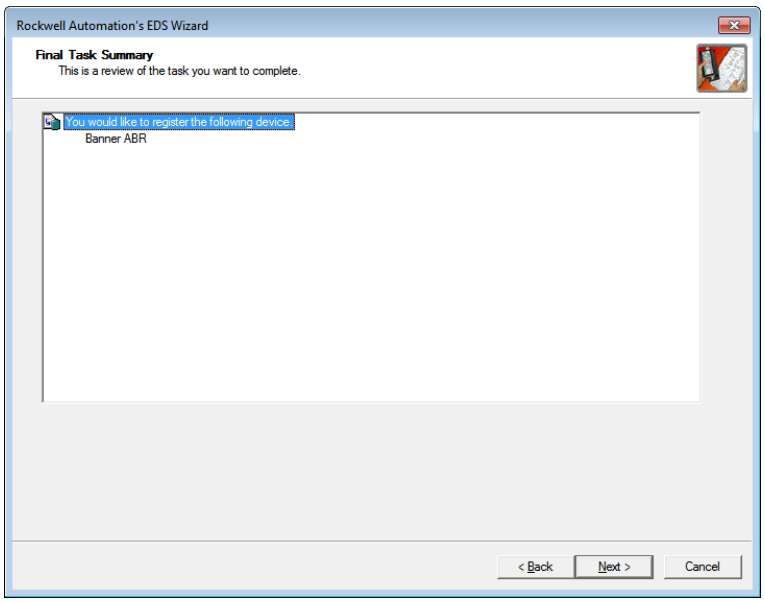
7. Click **Next** when you see the icon associated with the EDS file.

Figure 70. Rockwell Automation's EDS Wizard



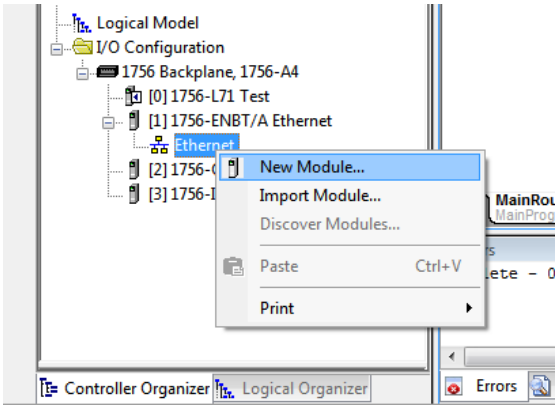
8. Click **Next** to register the EDS file.

Figure 71. Register the EDS File



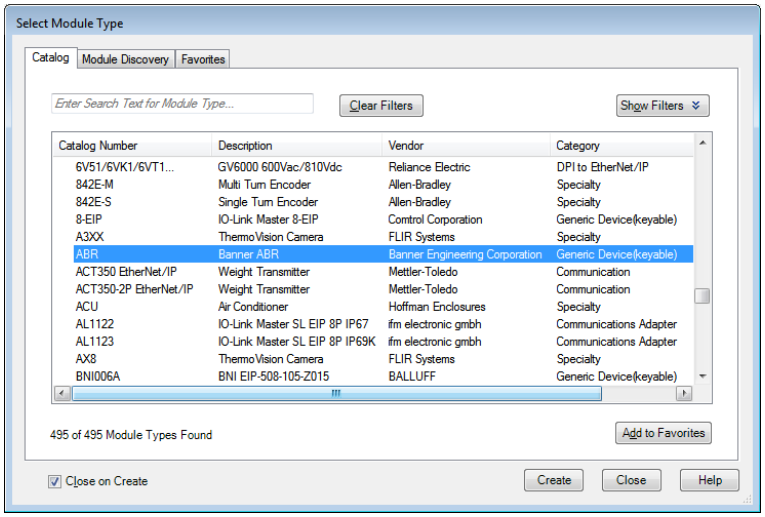
9. Click **Finish** to close the **EDS Wizard** .
10. Right-click on the PLC's Ethernet adapter and select **New Module...**

Figure 72. New Module



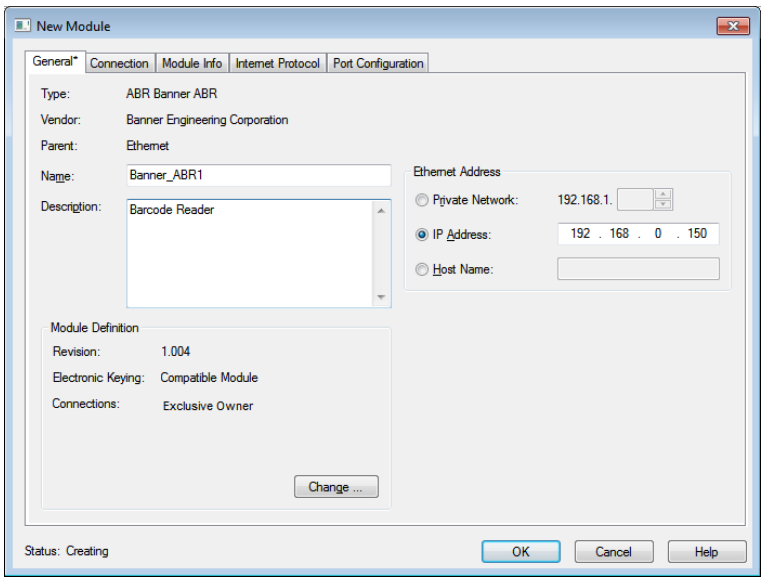
11. Locate the ABR from the catalog and click **Create**.

Figure 73. Select Module Type



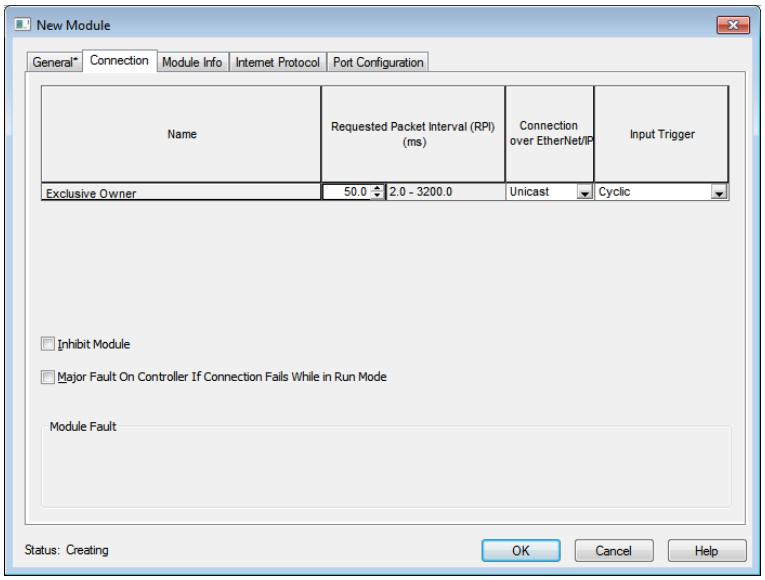
12. Enter a name, description (optional), and IP address for the ABR.

Figure 74. New Module



13. Set the desired **Request Packet Interval (RPI)** on the **Connection** tab.

Figure 75. New Module—Connection Settings

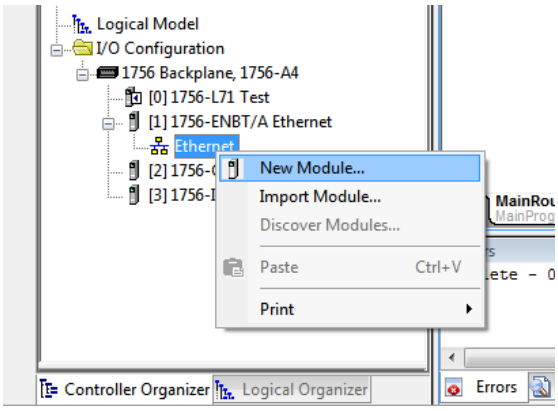


8.2.4 ABR Series Manual Installation in Studio 5000 Logix Designer Software

If the EDS file installation in the previous section is not possible, follow the steps of this section. Otherwise skip this section.

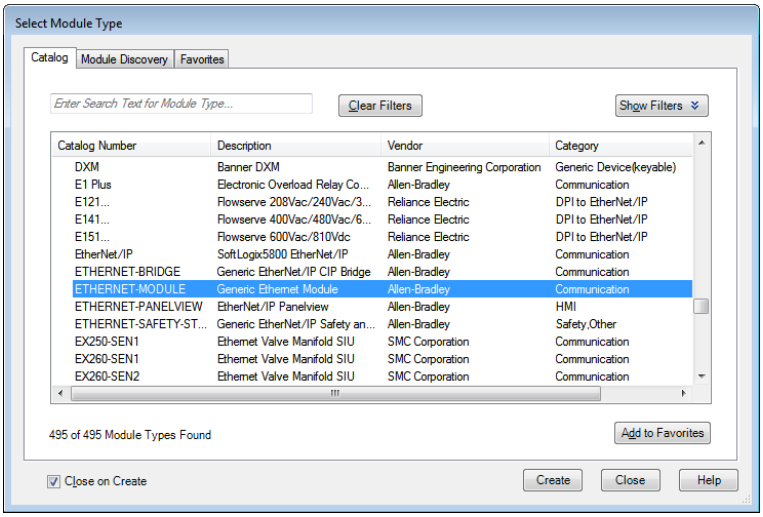
1. Add a generic Ethernet module to the PLC's Ethernet card.
   a) Click **New Module**.

Figure 76. Add Ethernet Module



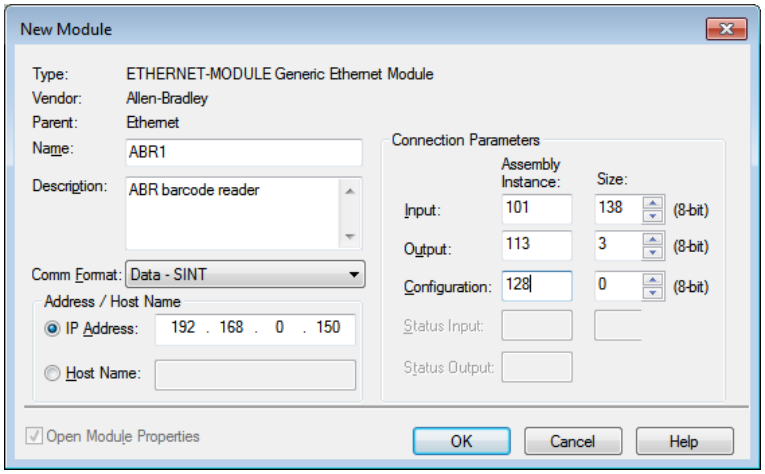
b) Select **Generic Ethernet Module**.

Figure 77. Select Module Type



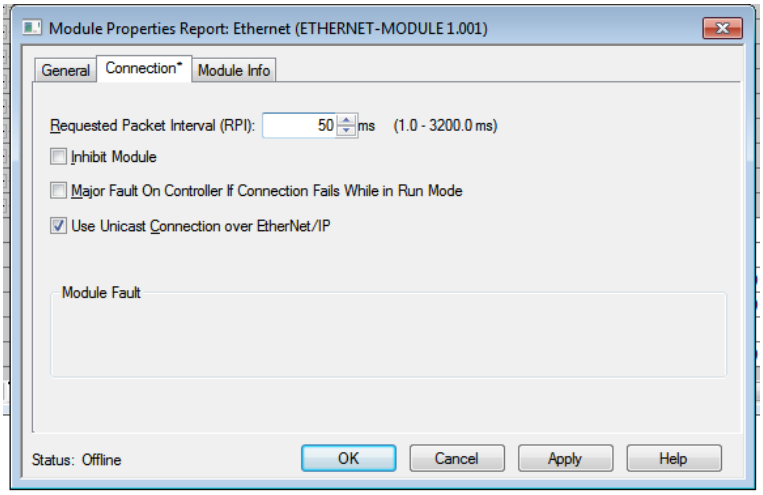
2. Configure the Module Properties, including the **Name** and **IP Address** of your choice, and using the **Connection Parameters** and **Comm Format** shown.

Figure 78. Module Properties



3. Click **OK**.
4. Set the desired **Request Packet Interval (RPI)** value and click **OK**.

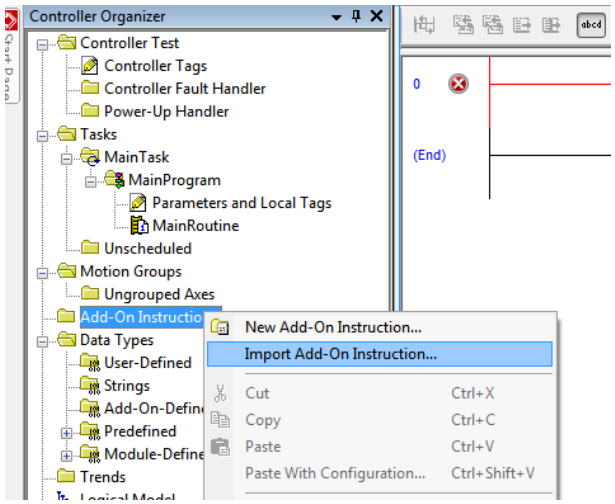
Figure 79. Module Properties Report: Ethernet



8.2.5 ABR Series AOI Installation in Logix Designer Software

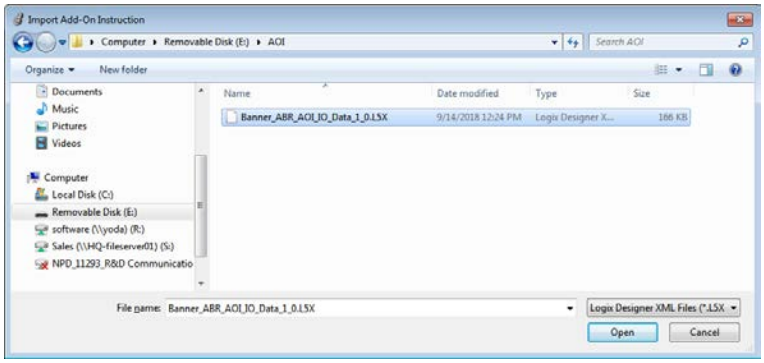
1. Download the Add-On Instruction (AOI) file `Banner_ABR_AOI_IO_Data_2_0.L5X` from www.bannerengineering.com.
2. In the **Controller Organizer** window, right-click on the **Add-On Instruction** folder and select **Import Add-On Instruction**.

Figure 80. Import Add-On Instruction



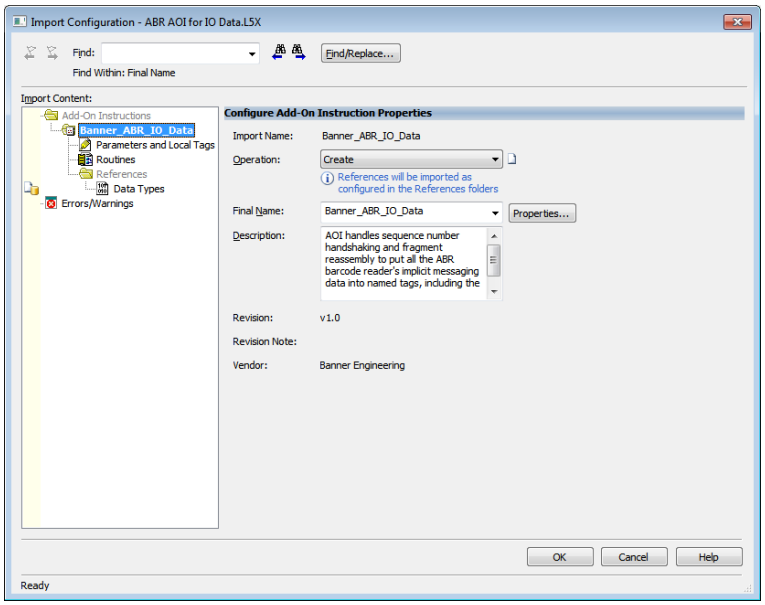
3. Navigate to the correct file location, and select the AOI to be installed.

Figure 81. Select Add-On Instruction



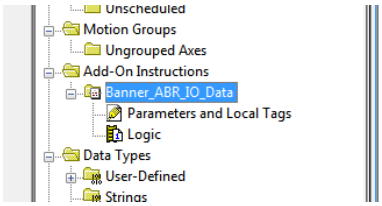
4. Click **Open**.
   The **Import Configuration** window opens. The default selection creates all of the necessary items for the AOI.

Figure 82. Import Configuration



5. Click **OK** to complete the import process.
   The AOI is added to the Controller Organizer window and looks similar to the following figure:

Figure 83. AOI Successfully Imported



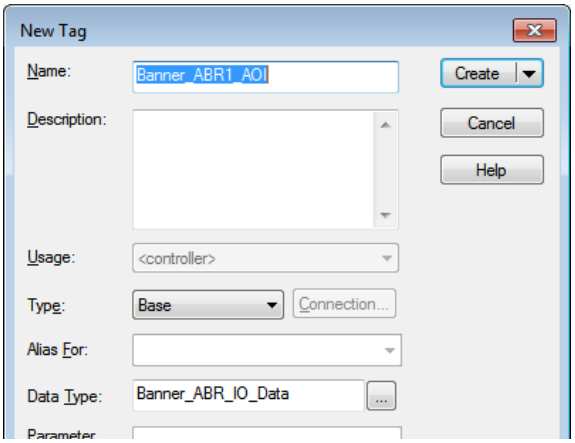
6. Drag the AOI from the Controller Organizer to your ladder logic program to add the `Banner_ABR_AOI_IO_Data` AOI to the program.

Figure 84. New AOI Added to the Program



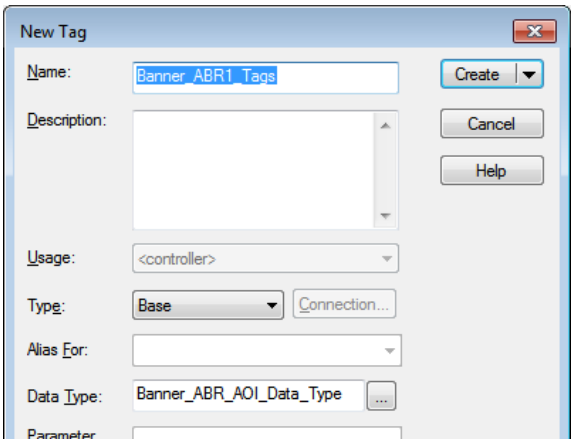
7. For each of the questions marks, create and link a new tag array.
   The AOI includes a new type of User Defined Tag (UDT), a custom array of tags meant specifically for this AOI.
   a) In the AOI, right-click on the question mark on the line labeled "Banner_ABR_IO_Data" and click **New Tag**. In this example, use the name "Banner_ABR1_AOI."

Figure 85. New Tag



b) Click the question mark on the RawDataFromABR line.
A list of tags displays.
c) Select the appropriate tag. In this example, select Banner_ABR1:I.Data.
This tag was created automatically when the new Ethernet Module was named (see ABR Series EDS File Installation in Studio 5000 Logix Designer Software on p. 54 and ABR Series Manual Installation in Studio 5000 Logix Designer Software on p. 58).
d) Click the question mark on the RawDataToABR line.
e) Select the appropriate tag. In this example, select Banner_ABR1:O.Data.
f) In the AOI, right-click on the question mark on the line labeled "ABR_AOI_Tags" and click **New Tag**. In this example, use the name "Banner_ABR1_Tags."

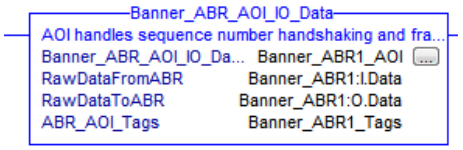
Figure 86. New Tag



The AOI is ready to run.

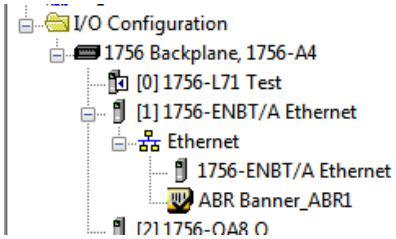
8. Download the program to the PLC, run it, and put the PLC into Online mode to view live data.

Figure 87. AOI Rung After All Tags are Assigned



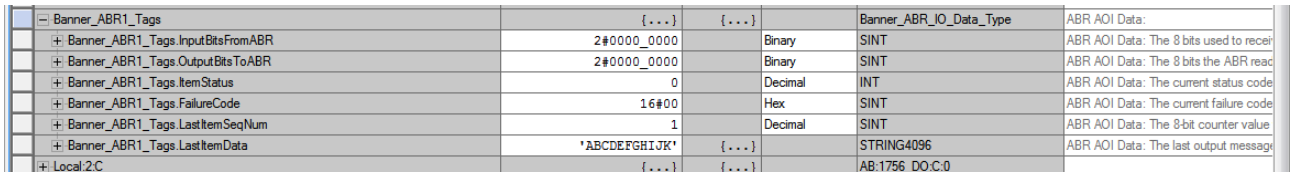
9. Verify that the Banner ABR Ethernet Module is connected by making sure that there is not a yellow warning symbol over the module icon in the Controller Organizer. If there is no symbol, the ABR has a live connection to the PLC.

Figure 88. Icon—No Errors



10. Go to Controller tags and verify that the **LastItemSeqNum** tag is incrementing every time the reader sends a result message.
11. If the tag is not incrementing, and the module showed a good connection in step 10, make sure that the reader is in run mode or monitor mode. If it is, your AOI should be fully functional and receiving all the useful implicit messaging data from the ABR.

Figure 89. AOI Data Tags



Banner_ABR1_Tags	{...}	{...}		Banner_ABR_IO_Data_Type	ABR AOI Data:
Banner_ABR1_Tags.InputBitsFromABR	2#0000_0000		Binary	SINT	ABR AOI Data: The 8 bits used to recei
Banner_ABR1_Tags.OutputBitsToABR	2#0000_0000		Binary	SINT	ABR AOI Data: The 8 bits the ABR reac
Banner_ABR1_Tags.ItemStatus	0		Decimal	INT	ABR AOI Data: The current status code
Banner_ABR1_Tags.FailureCode	16#00		Hex	SINT	ABR AOI Data: The current failure code
Banner_ABR1_Tags.LastItemSeqNum	1		Decimal	SINT	ABR AOI Data: The 8-bit counter value
Banner_ABR1_Tags.LastItemData	'ABCDEFGHIJK'	{...}		STRING4096	ABR AOI Data: The last output messag
Local:2:C	{...}	{...}		AB:1756_DO:C:0	

8.2.6 AOI Data Description

The AOI's data, all contained in one User-Defined data type (UDT) tag array, contains the data tags described in the following sections.

InputBitsFromABR

The Input Bits tag is a bitmap used to read the state of the 8 discrete inputs from the ABR reader. These should update live to always show the latest result, even if the PLC is not caught up at transferring all the result messages.

OutputBitsToABR

The Output Bits attribute is a bitmap used to control the state of the 8 discrete outputs to the ABR reader. This can be used to trigger the reader by setting to 1 the bit ABR1_Tags.OutputBitsToABR.0, for example, as described in Industrial Ethernet Reading Phase Control on p. 46.

ItemStatus

The Item Status Code is the status of the last reading attempt and is always updated live regardless of whether the PLC has finished receiving all the fragments of the previous message. The following table shows the status codes and their meanings.

Item Status Code	Item Status Name
0×0000	Good Read
0×0001	Complete, No Read
0×0002	Partial Read
0×0003	Multiple Read
0×0004	Wrong Read

FailureCode

The Failure Code is set when an error occurs with the reader. The following is a table of Failure Codes:

Failure Code	Name
0×01	Input Failure
0×02	Communications Failure
0×04	Reader Failure
0×08	Software Error
0×10	Remote Failure

LastItemSeqNumber

The Last Item Sequence Number is written with the Item Sequence Number by the Originator (PLC) to acknowledge the receipt of the Item Data. If fragmentation is used, this value is not written until the complete message is received.

LastItemData

LastItemData is the 4096 byte String tag that contains the last full message transferred by the ABR to the PLC. This tag's data and length are updated at the same time as LastItemSeqNumber, after all fragments of the message have been re-assembled in the AOI. It might not always be the latest result message generated by the ABR if the PLC has fallen behind and the ABR is buffering multiple results waiting to finish sending them to the PLC. Only the bytes that fall within the size of the last message are overwritten, so there could also be old data left in the upper array addresses when a shorter message arrives than the previous message.

8.3 MODBUS® TCP

The MODBUS® [27] TCP protocol provides device information using register and coil banks defined by the ABR.

This section defines the register and coil banks. By specification, MODBUS TCP uses TCP port 502. Select in Barcode Manager whether the ABR will function as a MODBUS TCP Client (also known as a MODBUS Master), or as a MODBUS TCP Server (also known as a MODBUS Slave).

MODBUS Function Codes Used

02: Read Input Status
05: Force Single Coil
16: Preset Multiple Registers

8.3.1 ABR Output Message Data

The ABR output messages are written to the 16-bit Holding Registers (40000).

The maximum message size is to 255 registers. This allows for up to 510 8-bit ASCII characters per message. If the message is longer than 510 characters only the first 510 characters are written, and the rest are discarded. The data is written in Big Endian format, with the first character of the message written to the upper byte, and the next character written to the lower byte of the first register. If the message is shorter than the number of registers being written, the ABR writes a 0 value to the extra bytes.

The following table shows the contents of the registers if 255 registers are being written, and the output message is: `[STX]123[ETX]`

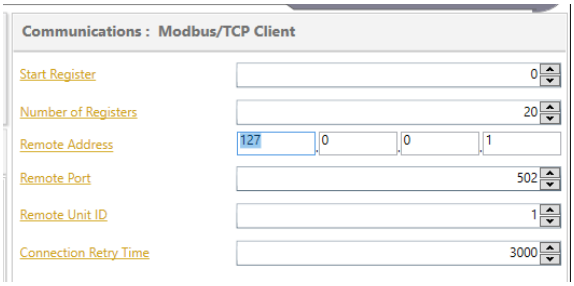
Table 5: ABR Output Message Data (40001–40255)

16: Preset Multiple Registers		
Register	**High Byte Contents (Bits 8-15)**	**Low Byte Contents (Bits 0-7)**
40001	[STX]	1
40002	2	3
40003	[ETX]	[Null]
40004	[Null]	[Null]
40005	[Null]	[Null]
40006	[Null]	[Null]
...	...	...
40255	[Null]	[Null]

8.3.2 Configure the ABR for MODBUS® TCP Client in Barcode Manager

After selecting **MODBUS TCP Client** on the **Reading Phase**, **Communications**, or **Output Setup** pages (see Industrial Ethernet Reading Phase Control on p. 46), the Control panel shows the following MODBUS TCP Client-specific settings:

Figure 90. MODBUS TCP Client-specific Settings and Their Default Values



[27] MODBUS® is a registered trademark of Schneider Electric USA, Inc.

Start Register

Defines the offset added to the **Starting Address** field of the MODBUS TCP message. If set to 5, the output messages are written from 40006 to 40025 instead of from 40001 to 40020.

Number of Registers

Defines the maximum number of registers according to the maximum length of the message to be transmitted. The size of the message transmitted is constant, thus, it must be big enough to contain the largest barcode information.

Remote Address

Defines the IP address of the server to which the client tries to connect.

Remote Port

Defines the port number of the server to which the client tries to connect. It must be different from the port numbers defined for other communications functions.

Remote Unit ID

Defines the unit identifier used with MODBUS TCP devices that are composites of several MODBUS devices, for example on MODBUS TCP to MODBUS RTU gateways. In these situations, the unit identifier tells the Slave Address of the device behind the gateway. By default, MODBUS TCP-capable devices usually ignore the unit identifier

Connection Retry Time

Defines a timeout (in milliseconds) for the Industrial Protocol Client before the client retries the connection between the client and the server. If the connection is not successful, further retries are attempted after this timeout expires. If set to 0 there is no retry attempt.

After changing settings, click **Play** , **Monitor** , or **Getting Started** to activate the Industrial Ethernet communications with the new settings.

In MODBUS TCP Client mode, the ABR reads the Input Bits every 50 milliseconds from the PLC (or other MODBUS TCP server) as Inputs (10000) using MODBUS function code 02 (Read Input Status). The state of the ABR Output Bits are written to the PLC on Coils (00000) using MODBUS function code 05 (Write Single Coil). The following tables show the address locations of the input and output bits.

Table 6: ABR Input Bits (10001–10008)

02: Read Input Status	
Register	**ABR Input Bit Position**
10001	Input Bit 0
10002	Input Bit 1
10003	Input Bit 2
10004	Input Bit 3
10005	Input Bit 4
10006	Input Bit 5
10007	Input Bit 6
10008	Input Bit 7

Table 7: ABR Output Bits (00001–00008)

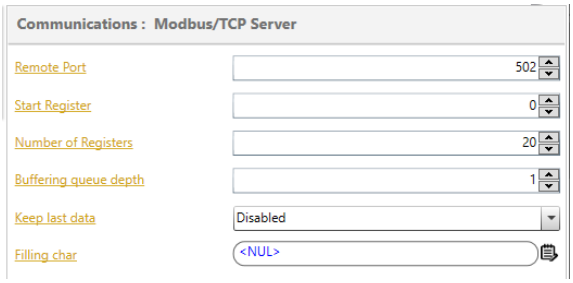
05: Write Single Coil	
Register	**ABR Output Bit Position**
00001	Output Bit 0
00002	Output Bit 1
00003	Output Bit 2
00004	Output Bit 3
00005	Output Bit 4
00006	Output Bit 5

05: Write Single Coil	
Register	**ABR Output Bit Position**
00007	Output Bit 6
00008	Output Bit 7

8.3.3 Configure the ABR for MODBUS® TCP Server in Barcode Manager

After selecting MODBUS TCP Server on the **Reading Phase**, **Communications**, or **Output Setup** pages (see Industrial Ethernet Reading Phase Control on p. 46), the Control panel shows the following MODBUS TCP Server-specific settings:

Figure 91. MODBUS TCP Server-Specific Settings and Their Default Values



Remote Port

Defines the port number of the server to which the client tries to connect. It must be different from the port numbers defined for other Server Channels.

Start Register

Defines the offset added to the **Starting Address** field of the MODBUS TCP message. If set to 5, the output messages are written from 40006 to 40025 instead of from 40001 to 40020.

Number of Registers

Defines the maximum number of registers according to the maximum length of the message to be transmitted. The size of the message transmitted is constant, thus, it must be big enough to contain the largest barcode information.

Buffering Queue Depth

It defines the size of the circular queue used by MODBUS to store codes generated by the ABR reader but not yet read by the PLC.

Keep Last Data

When enabled, the last code generated by the ABR reader is always sent to the PLC, even if the PLC has already read it.

Filling Char

Define padding characters used to fill in registers where no new data is present.

After changing settings, click **Play** , **Monitor** , or **Getting Started** to activate the Industrial Ethernet communications with the new settings.

In MODBUS TCP Server mode, the PLC (or other MODBUS TCP Client) reads the ABR Output Bits as Inputs (10000) using MODBUS function code 02 (Read Input Status). The PLC writes to the ABR Input Bits on Coils (00000) using MODBUS function code 05 (Write Single Coil). The following tables show the address locations of the input and output bits.

Table 8: ABR Input Bits (00001–00008)

05: Write Single Coil	
Register	**ABR Input Bit Position**
00001	Input Bit 0
00002	Input Bit 1
00003	Input Bit 2
00004	Input Bit 3

05: Write Single Coil	
Register	**ABR Input Bit Position**
00005	Input Bit 4
00006	Input Bit 5
00007	Input Bit 6
00008	Input Bit 7

Table 9: ABR Output Bits (10001–10008)

02: Read Input Status	
Register	**ABR Output Bit Position**
10001	Output Bit 0
10002	Output Bit 1
10003	Output Bit 2
10004	Output Bit 3
10005	Output Bit 4
10006	Output Bit 5
10007	Output Bit 6
10008	Output Bit 7

8.4 SLMP

According to the CC-Link website, "SLMP, or Seamless Message Protocol, is a feature of the CC-Link IE Field network that allows users to vertically integrate field devices with controllers to information systems, and seamlessly connect field systems to information systems".

In this section, the SLMP configuration of the ABR 3000 is shown. Despite some little differences, from here on SLMP and MC PROTOCOL words are used interchangeably. In Figure 92 on p. 67 and Table 10 on p. 68 is shown the actual system configuration (Mitsubishi CPU and additional modules), and device connections. GX Works 2 Version 1.577B has been used for configuration and programming purposes. The workstation and the PLC communicate over USB connection.

Figure 92. System Configuration

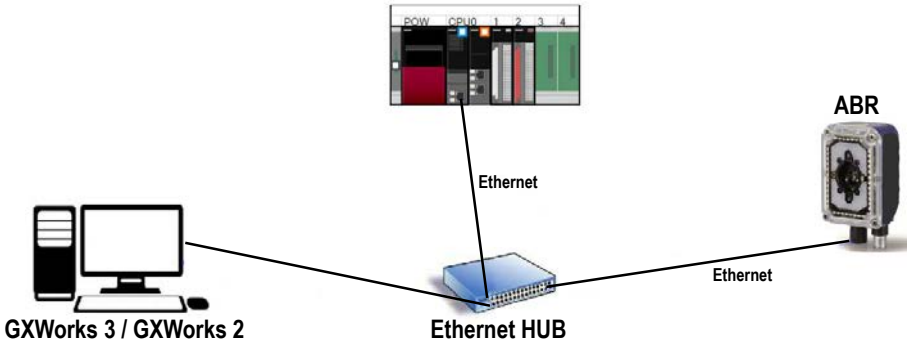


Figure 93. CPU and Additional Modules Configuration

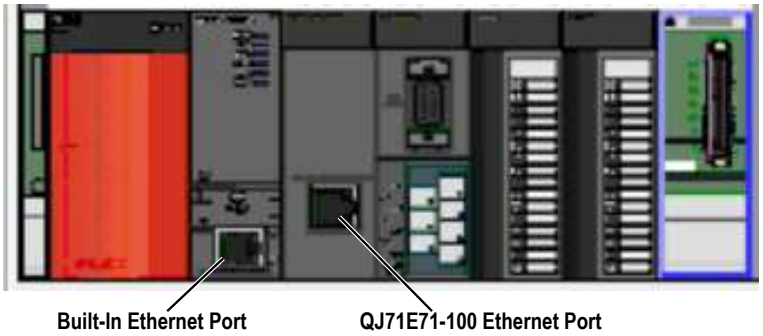


Table 10: CPU and Additional Modules

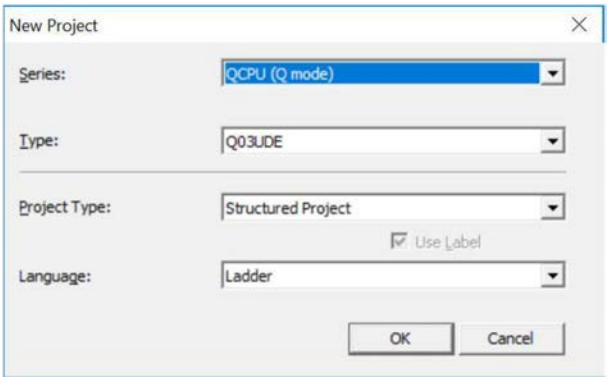
Base Slot	Model Name	I/O Address	IP Address
CPU	Q03UDECPU	-	192.168.3.39
0–0	QJ71E71-100	0000	192.168.3.101
0–1	QJ71C24N	0020	
0–2	QX40	0040	
0–3	QY40P	0050	
0–4	-	0060	

Because two network cards are present, Built-In Ethernet and QJ71E71-100, there are two methods to connect a device using SLMP protocol. Both methods are covered in the following sections.

8.4.1 SLMP Configuration: Built-In Ethernet Port

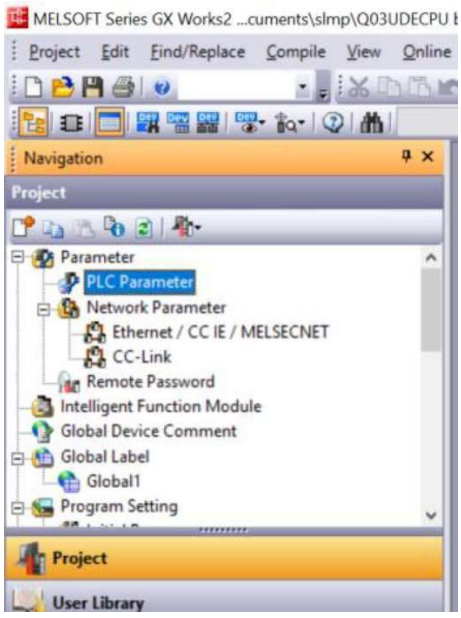
SLMP protocol on a built-in Ethernet port is possible starting from a new project or from an existing project.

Figure 94. New Project Window



1. Double-click **PLC Parameter**.

Figure 95. Existing Project Navigation



The **Q Parameter Setting** screen displays.

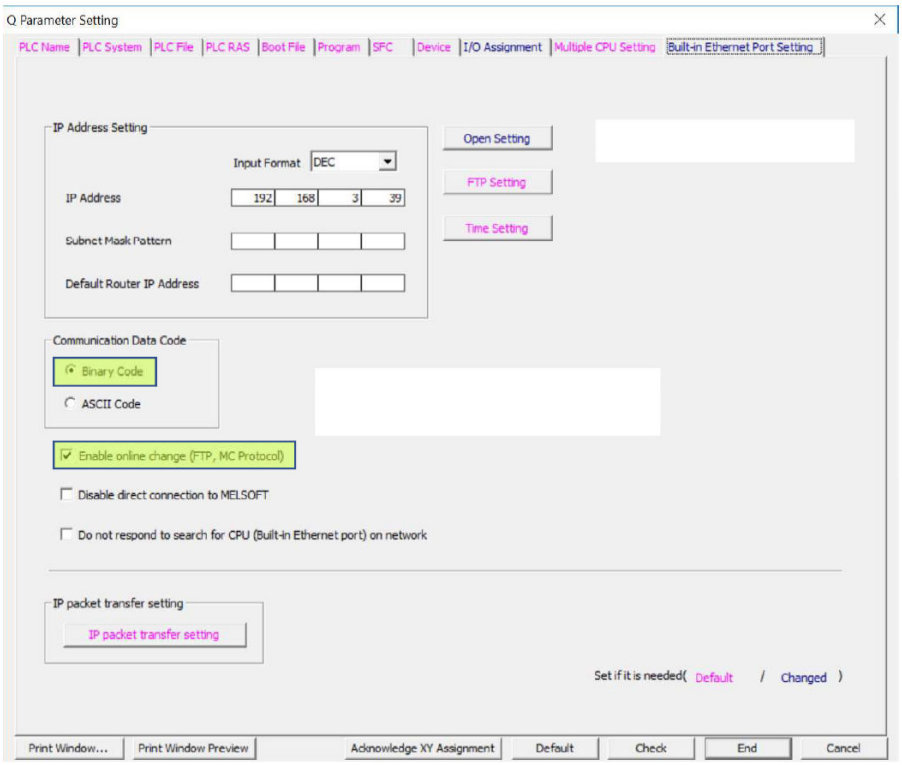
*Figure 96. **Q Parameter Setting** Screen*



2. From the **Q Parameter Setting** screen, click the **Built-In Ethernet Port Setting** tab.

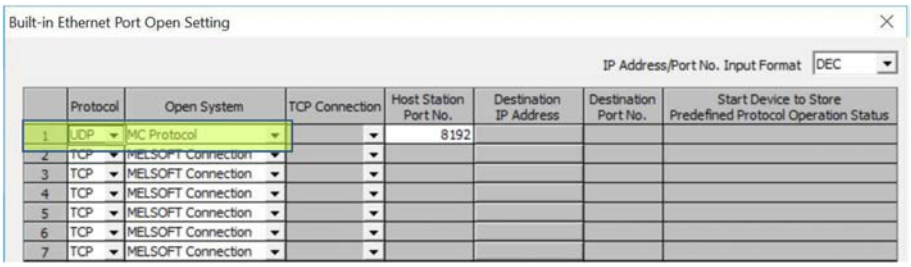
   From this tab, you can configure parameters such as the CPU network address and communication data code (binary/ASCII). It is also possible to allow an external device to modify process memory areas while CPU is running.
3. Select the **Binary Code** option and the **Enabled online change (FTP, MC Protocol)** checkbox, highlighted in the following figure.

*Figure 97. **Q Parameter Setting** Screen: **Built-In Ethernet Port Setting** Tab*



4. Click **Open Setting** next to the ID Address Setting.
   The **Built-In Ethernet Port Open Setting** screen opens.

*Figure 98. **Built-In Ethernet Port Setting** Screen*



5. From the **Built-In Ethernet Port Setting** screen, enable the SLMP (MC Protocol) and set up the UDP port.

   Choose any port number except those shown in Figure 98 on p. 69. The port number set here and the port number of the ABR must match.

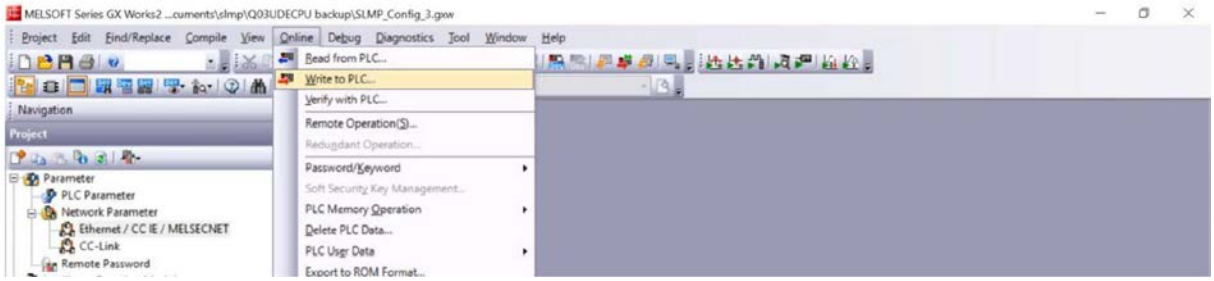
   The Host Station Port Number must be within the range of 1025 to 4999 or 5010 to 65534 (Dec).

6. Confirm the operation by clicking **End** on both the **Built-In Ethernet Port Open Setting** and **Q Parameter Setting** screens.
7. After the parameters are set, rebuild the entire project and download it to the PLC.

Figure 99. Compilation Menu



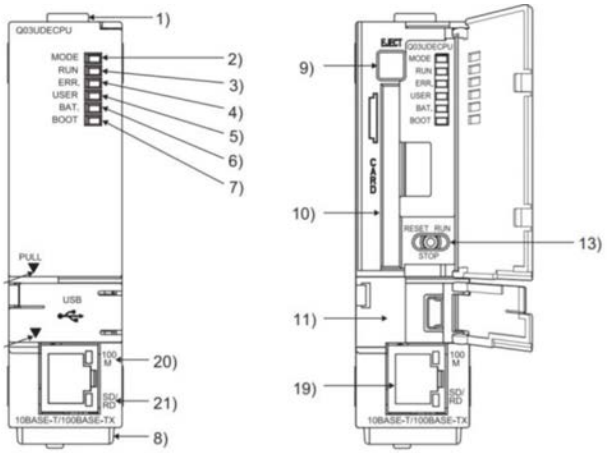
Figure 100. Project Download



8. Reset the hardware after the changes.

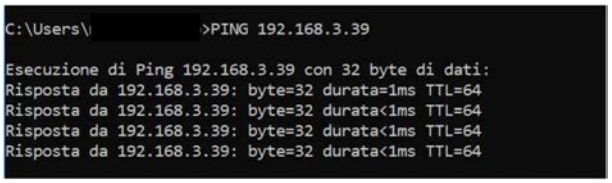
   This is required and can be done through switch 13, shown in the following figure.

Figure 101. CPU Drawing



9. After the hardware reset, execute a PING command to make sure of PLC reachability over the network.

Figure 102. Device PING



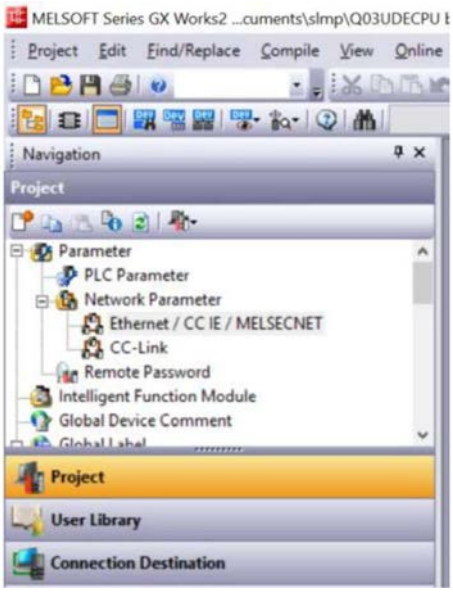
SLMP configuration of Built-In Ethernet port is complete.

Skip the next section if QJ71E71-100 Ethernet Module is not present or it is not necessary to configure SLMP on it.

8.4.2 SLMP Configuration: QJ71E71-100 Ethernet Module

1. Open the module configuration by expanding **Network Parameter** in the left column and double-clicking **Ethernet / CC IE / MELSECNET** .

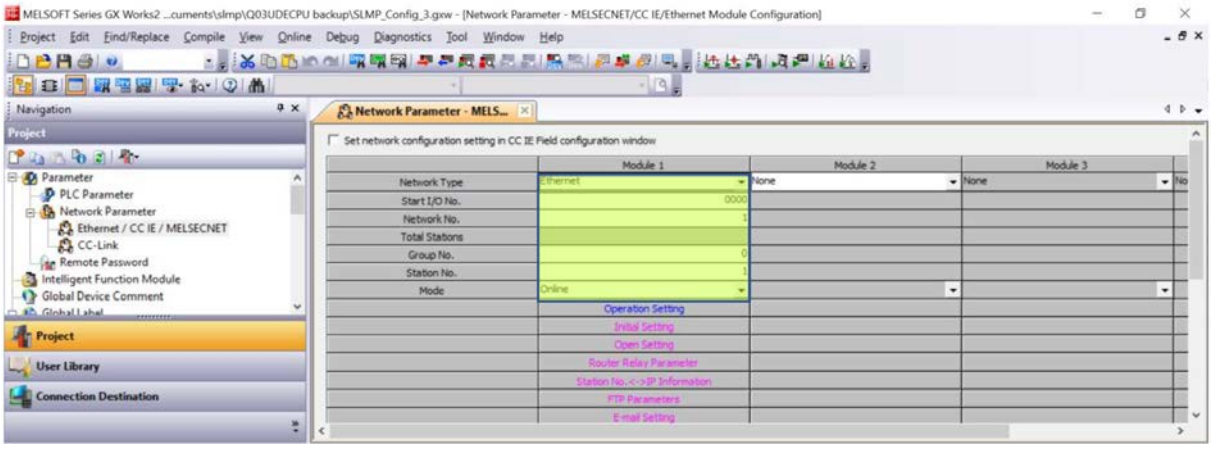
Figure 103. Project Navigation



The **Network Parameter** tab opens.

2. Enter the highlighted parameter in the **Module 1** column; see the following figure.

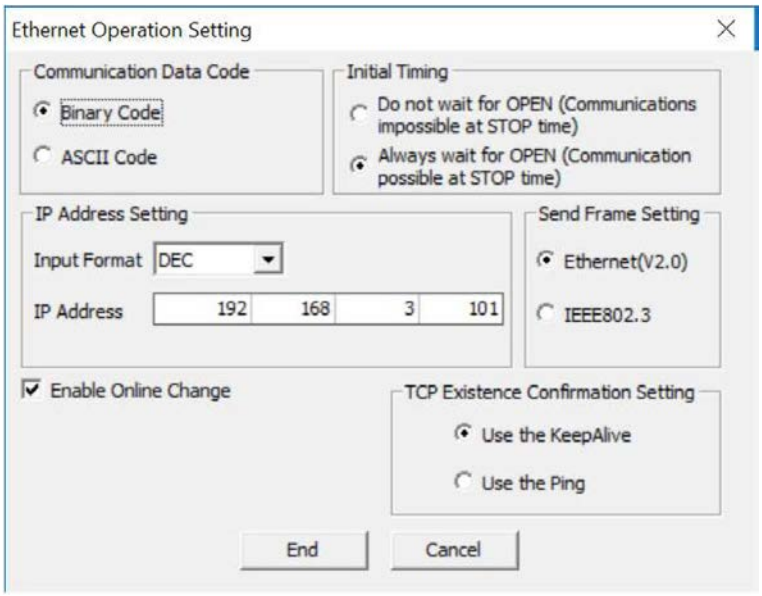
Figure 104. Project Navigation



3. Click **Operation Setting**.
   The **Ethernet Operation Setting** window displays.
4. Insert the same parameters as shown in the following figure.

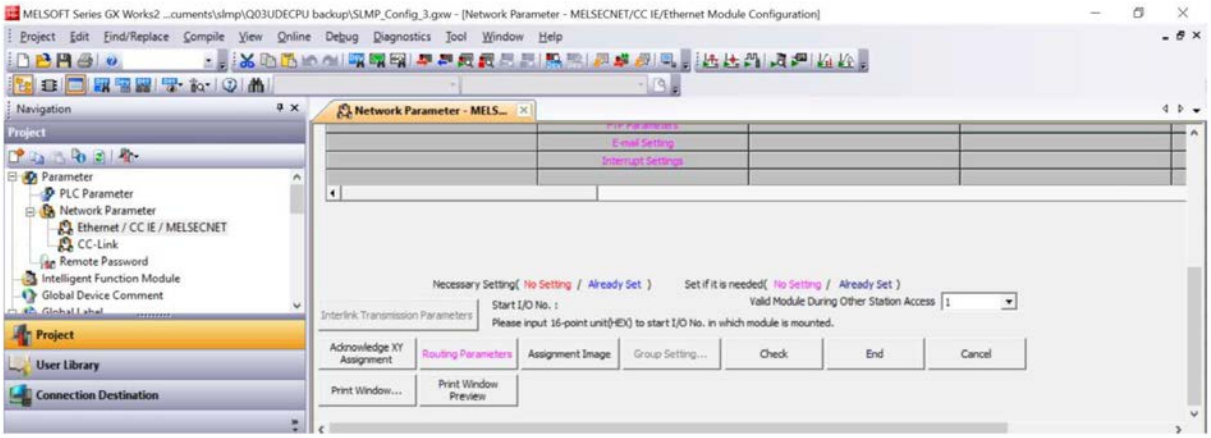
   A different IP address can be chosen.

Figure 105. QJ71E71-100 Ethernet Operation Setting



5. Click **End** to confirm the settings.
6. Click **End** at the bottom of the **Network Parameter** tab to save the settings.

Figure 106. Parameter Saving

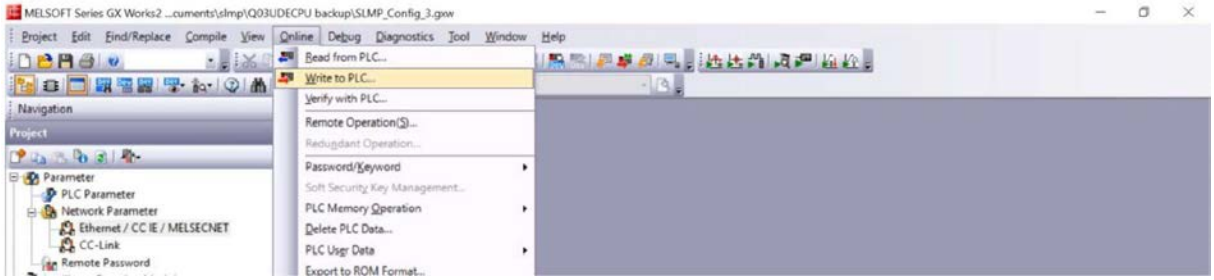


7. After the parameters are set, rebuild the entire project and download it to the PLC.

Figure 107. Compilation Menu

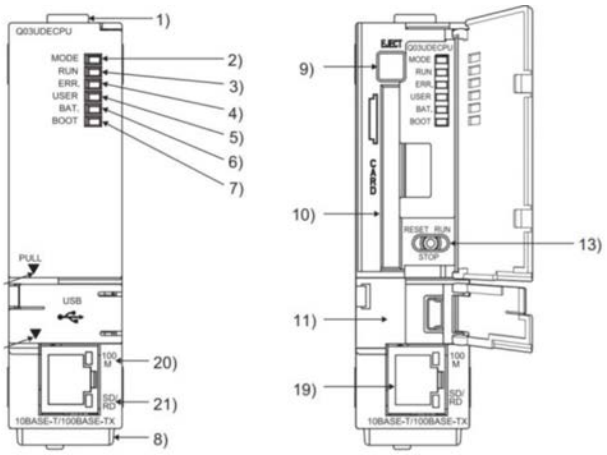


Figure 108. Project Download



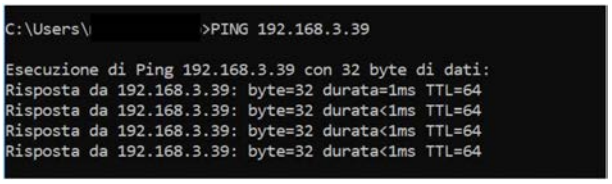
8. Reset the hardware after the changes.
   This is required and can be done through switch 13, shown in the following figure.

Figure 109. CPU Drawing



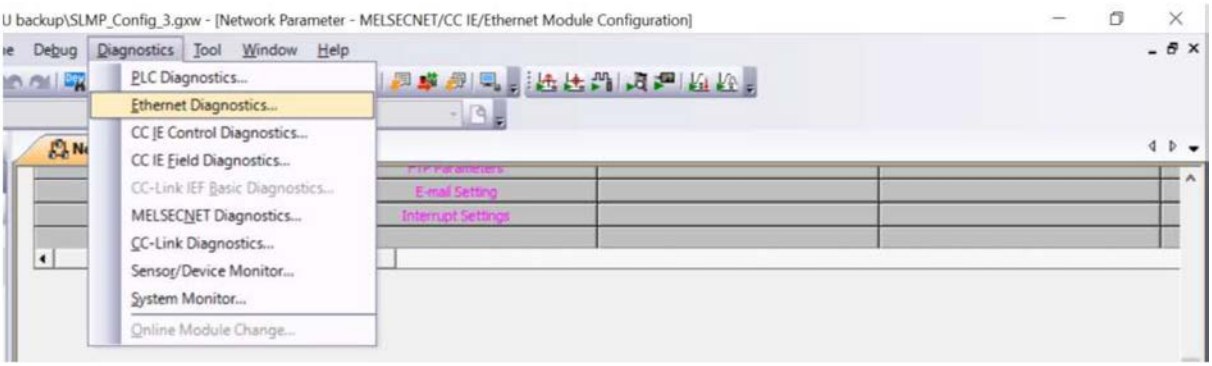
9. After the hardware reset, execute a PING command to make sure of QJ71E71-100 reachability over the network.

Figure 110. Device PING



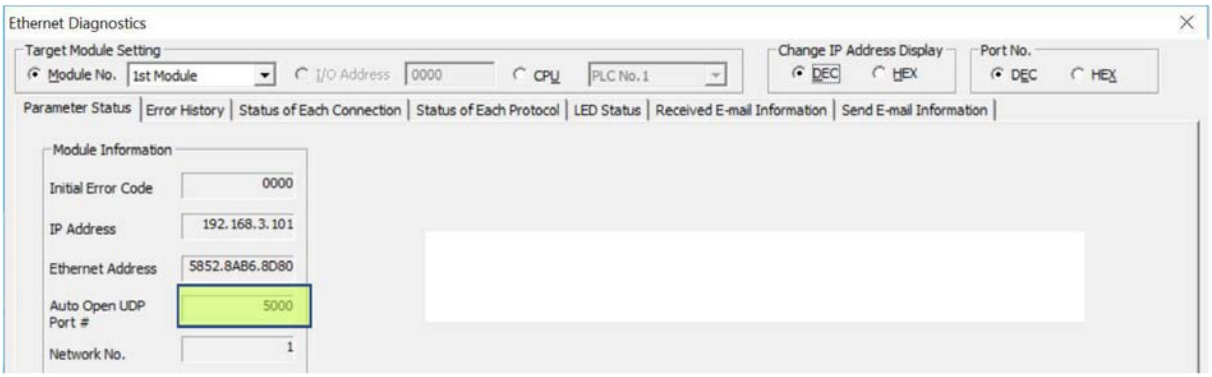
10. Verify the port number.
    Notice that no UDP port number setting has been made so far. The reason why this setting is not necessary is that the QJ71E71-100 Ethernet module has a listening UDP socket already open on port 5000 (Decimal), and on that port, the PLC responds to SLMP messages.
    a) Navigate to **Diagnostics** > **Ethernet Diagnostics**.

Figure 111. Diagnostic Menu



    b) Observe the Auto Open UDP Port #.
    This number must be set in the ABR configuration in the Barcode Manager software.

Figure 112. PLC Ethernet Diagnostics



The QJ71E71-100 Ethernet Module configuration is complete.

8.4.3 General Considerations

Note that **Enabled Online Change** must be enabled whatever PLC network card you choose, built-in or QJ71E71-100 Ethernet module, to allow a SLMP device to modify (write) PLC memory while control program is running.

8.4.4 ABR SLMP Configuration

Use the following steps to configure the ABR to enable SLMP Communication.

Refer to the Barcode Manager Manual for general settings. It is possible to modify an existing configuration or create a new one. Before starting, change the user to Installer Expert by navigating to **Options** > **Change User** > **Installer Expert**.

1. Enable the SLMP Protocol to allow communication. From the **Reading Phase** page, click **Add New Industrial Protocol** and select **SLMP**.

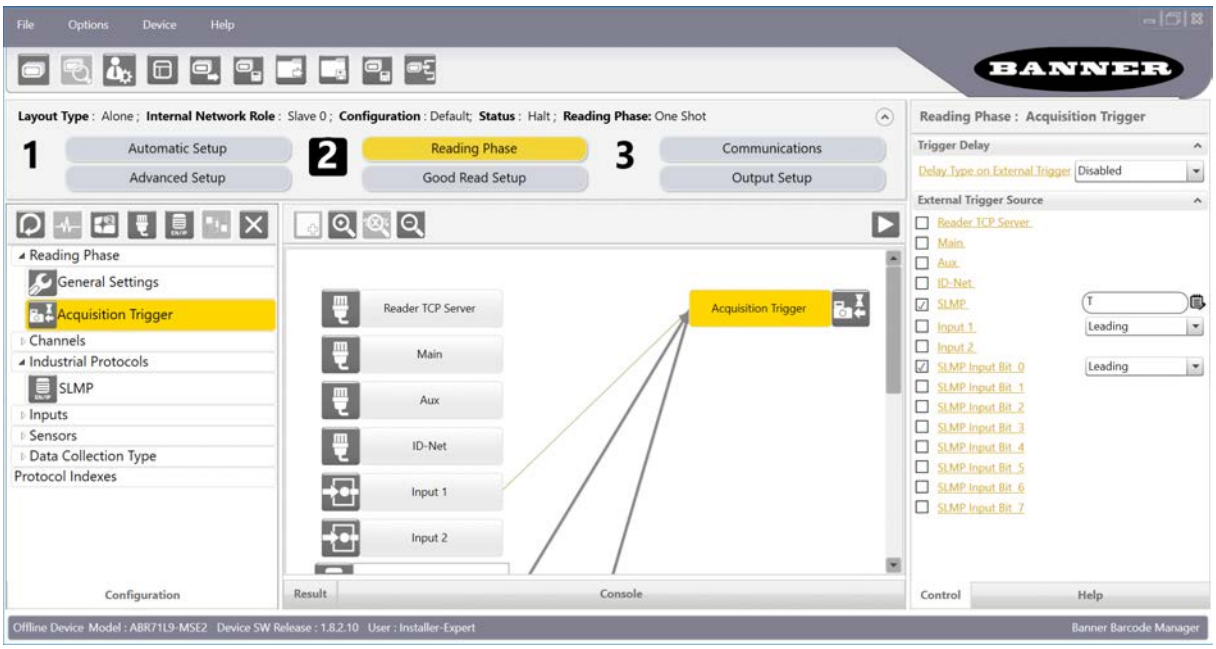
Figure 113. Enable SLMP



2. In the **Reading Phase: SLMP** pane, set the desired ABR Network parameters.
   - For Built-In Ethernet connection, choose the **Remote Port** from an admissible interval (see SLMP Configuration: Built-In Ethernet Port on p. 68)
   - For QJ71E71-100 Ethernet module connection, the **Remote Port** must be set to 5000
   - The **Remote Address** must match the PLC network card address
3. Set the PLC memory allocation:
   - **Number of Input Devices** and **Number of Output Devices** are the input and output exchange area width
   - **Input Offset** and **Output Offset** are the starting address of exchange areas in D memory of Q03UDE
4. Select **One Shot Mode**.
5. Select the Acquisition Trigger Source by selecting the following checkboxes:
   - **SLMP**
   - **SLMP Input Bit 0**

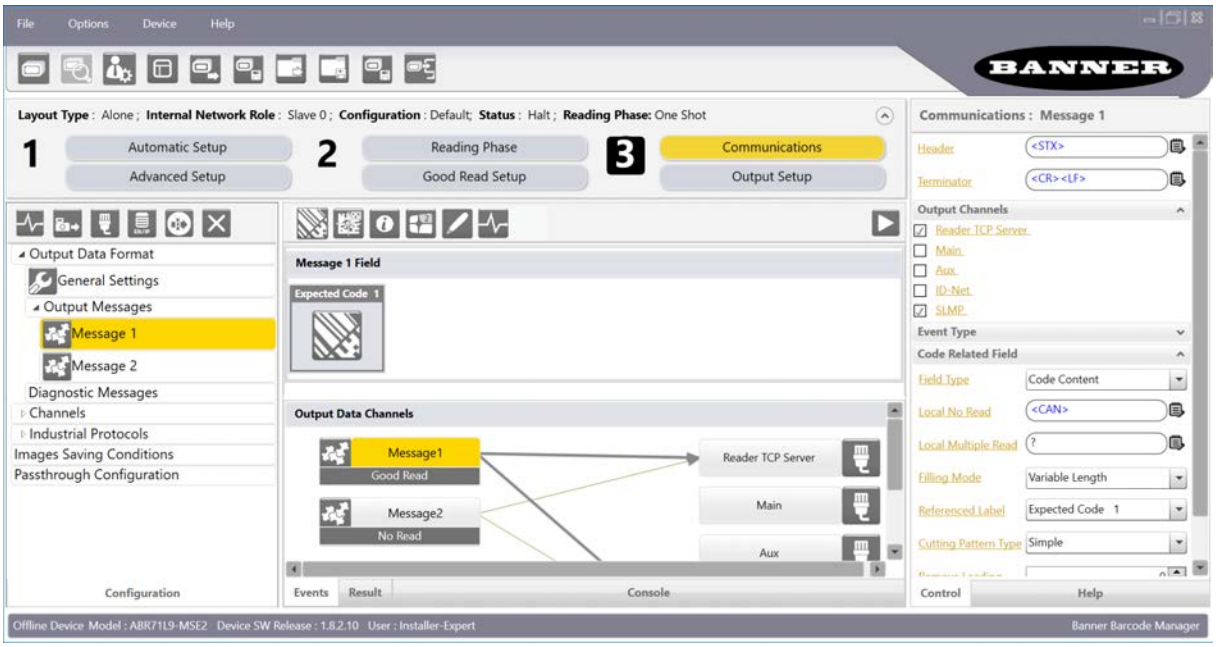
   For trigger control only by SLMP, clear the **Input 1** checkbox.

Figure 114. Acquisition Trigger Setting: One Shot Mode Settings Shown



6. Click **Communications**.
7. Redirect the reading message to SLMP for both read and no read results.
   a) From the Configuration Parameters tree area, select **Message 1**.
   b) On the Output Channels pane, select **SLMP**.
   c) From the Configuration Parameters tree area, select **Message 2**.
   d) On the Output Channels pane, select **SLMP**.

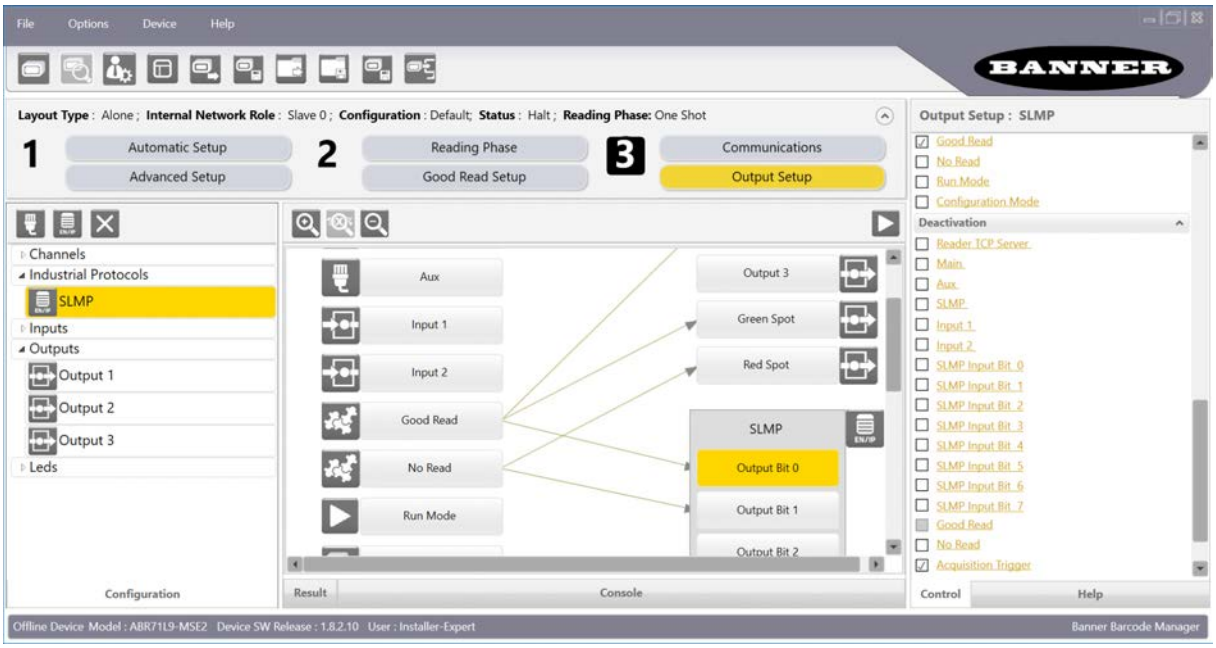
Figure 115. ABR Output Data Setting



8. Go to **Output Setup** > **Industrial Protocols** > **SLMP**.
9. Redirect the status output to SLMP and choose the activation and deactivation policy for both read and no read result.
   a) Click **Output Bit 0** in the center pane.
   b) On the Activation pane, select **Good Read**.
   c) On the Deactivation pane, select **Acquisition Trigger**.
   d) Click **Output Bit 1** in the center pane.

e) On the Activation pane, select **No Read**.
f) On the Deactivation pane, select **Acquisition Trigger**.

Figure 116. ABR Control Output Setting: Output Bit 0 Shown



10. After the settings are complete, save the configuration on the ABR.
The above configuration leads to following memory mapping:

Table 11: Resulting Output Configuration

ABR -> PLC	Byte 1	Byte 2
D228	Reserved	Digital I/O
D229	Data	Data
…	Data	Data
D259	Data	Data

Figure 117. Resulting Output Configuration

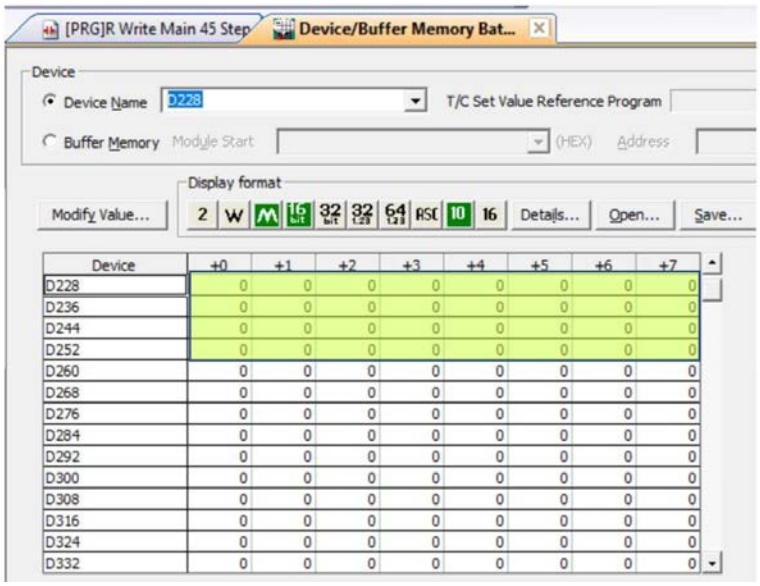
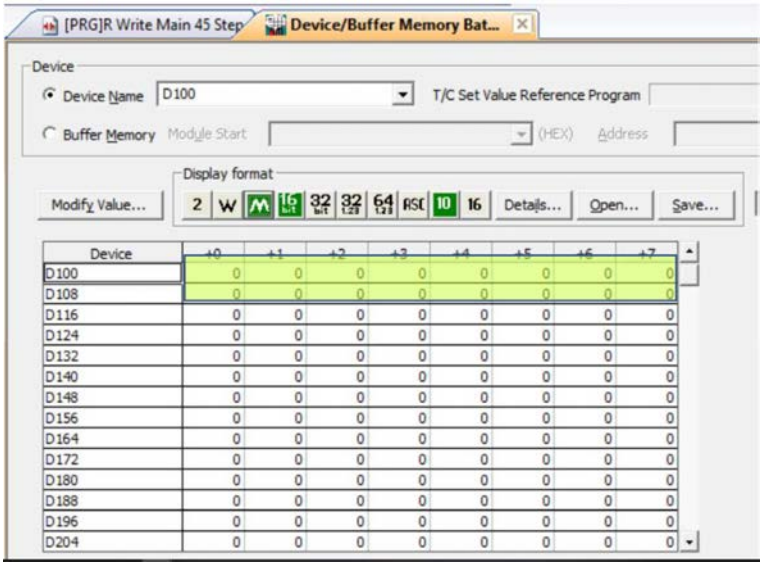


Table 12: Resulting Input Configuration

PLC-ABR	Byte 1	Byte 2
D100	Reserved	Digital I/O
D101	Data	Data
…	Data	Data
D115	Data	Data

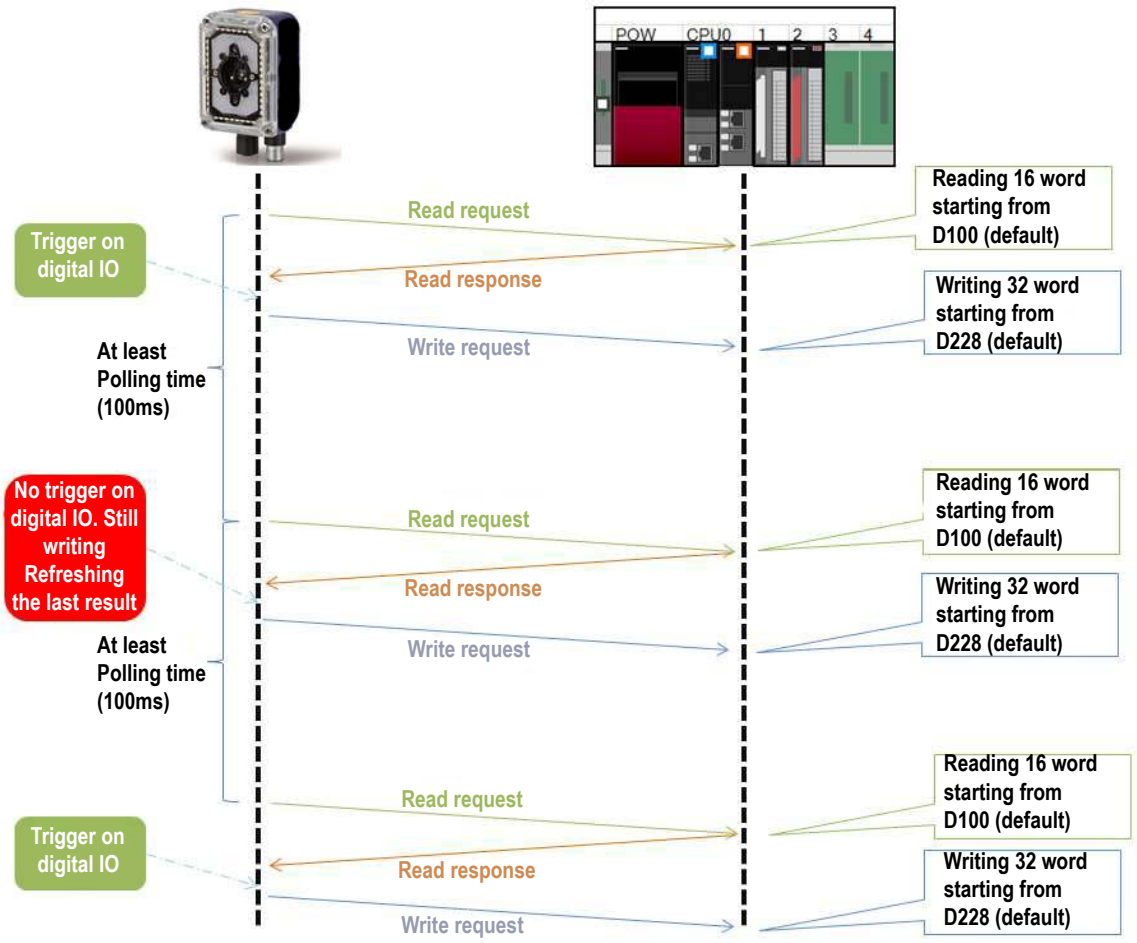
Figure 118. Resulting Input Configuration



8.4.5 PLC-ABR Communication Sequence

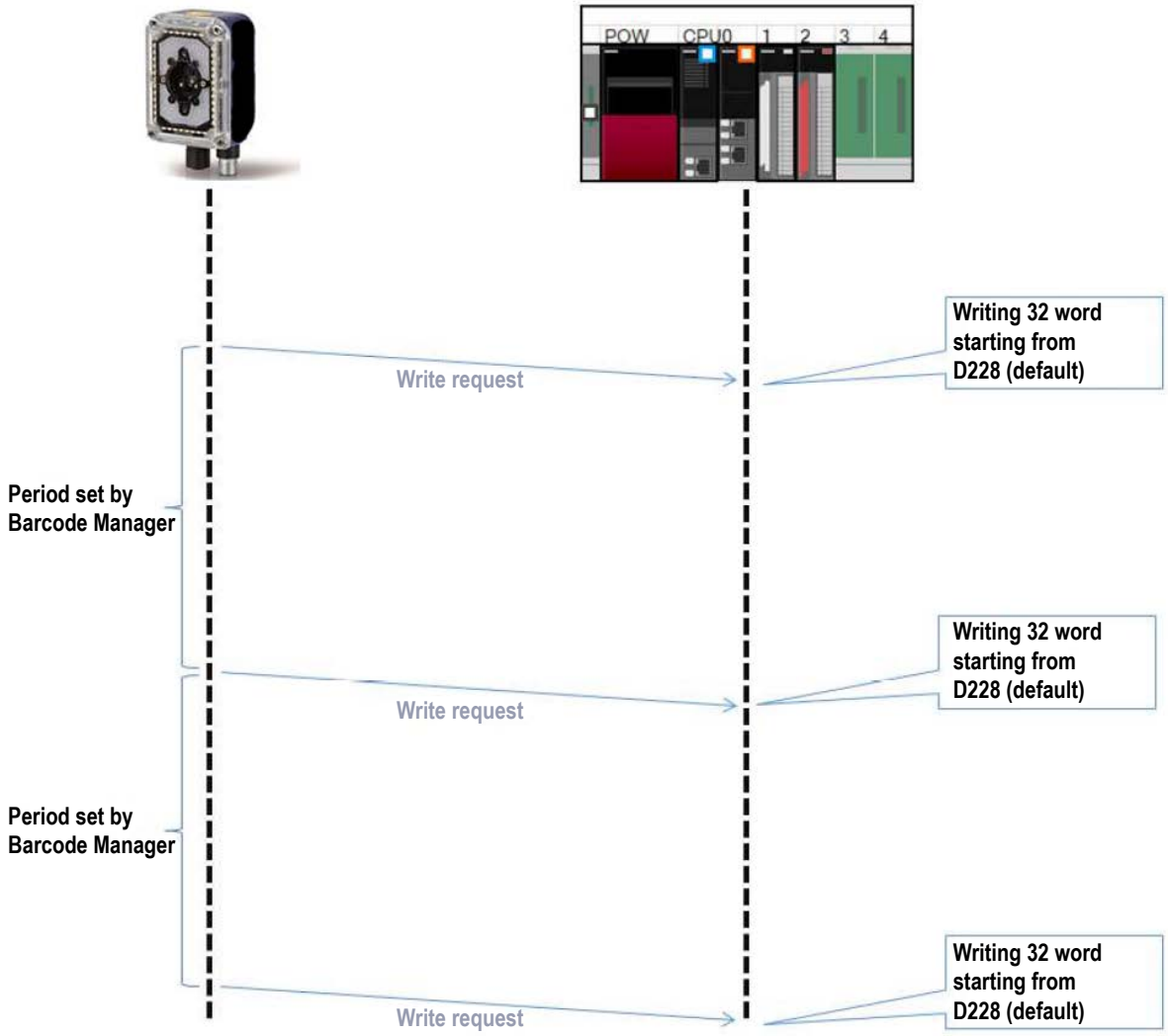
The following shows the communication flow and signal timing for both triggered and continuous acquisition mode. Note that the preceding configuration leads to triggered acquisition mode.

Figure 119. Triggered Communication Sequence



The interval between two read requests is at least equal to the polling time set in Barcode Manager.
Alternatively, it is possible to set ABR in continuous triggering mode. In this mode any trigger command is needed.

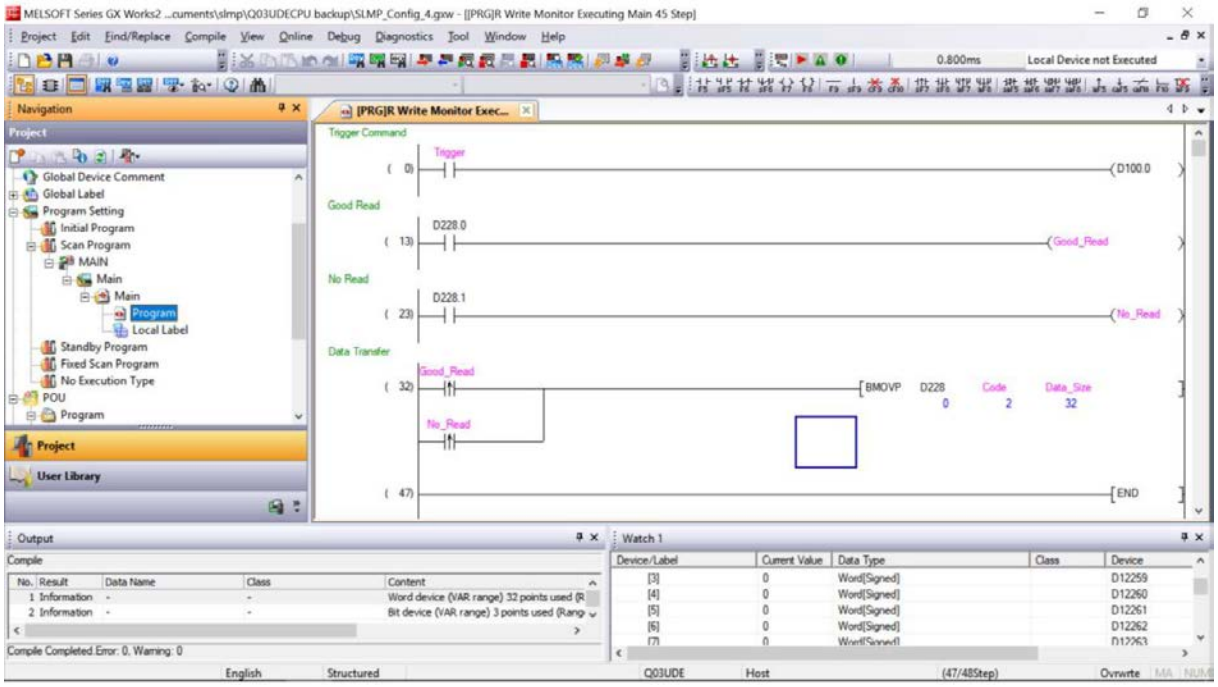
Figure 120. Periodic Communication Sequence



8.4.6 GX Works 2 Sample Program

The following figure shows a sample ladder program for implementing triggered acquisition.

Figure 121. Sample Ladder Program



8.4.7 Connection of Multiple Devices

Whichever type of PLC network card is used, each device needs a unique IP address chosen in the same subnet. Input and output offsets must be chosen to avoid overlaps. For simplicity, input and output area size (Number of Input Devices and Number of Output Devices) are 50 words wide.

Ethernet Module Example

In this example, the devices are connected to QJ71E71-100 Ethernet module, and the IP address specified is 192.168.3.101. Table 13 on p. 80 shows a possible configuration in Barcode Manager. Note that 192.168.3.101 must not be assigned to any ABR device to avoid IP conflict.

Table 13:

	Device IP	Remote Address	Remote Port	Number of Input Devices	Input Offset	Number of Output Devices	Output Offset
Device 1	192.168.3.1	192.168.3.101	5000	50	100	50	150
Device 2	192.168.3.2	192.168.3.101	5000	50	200	50	250
…							
Device n	192.168.3.n	192.168.3.101	5000	50	100×n	50	100×n+50

Built-In Ethernet Module Example

In this example, the devices are connected to a built-in Ethernet module, the IP address specified is 192.168.3.39, and the host port station is chosen in an allowable interval. Table 14 on p. 81 shows a possible configuration in Barcode Manager. Note that 192.168.3.39 must not be assigned to any ABR device to avoid IP conflict.

Table 14:

	Device IP	Remote Address	Remote Port	Number of Input Devices	Input Offset	Number of Output Devices	Output Offset
Device 1	192.168.3.1	192.168.3.39	any	50	100	50	150
Device 2	192.168.3.2	192.168.3.39	any	50	200	50	250
…							
Device n	192.168.3.n	192.168.3.39	any	50	100×n	50	100×n+50

8.5 PROFINET® Compatible

PROFINET® [31] is a data communication protocol for industrial automation and processes. PROFINET IO defines how controllers (IO controllers) and peripheral devices (IO devices) exchange data in real time.

The ABR 3000 supports PROFINET IO. The data communication protocol is TCP/IP; the data transmission medium is copper wire; the PROFINET conformance class is CC-A. [32]

Note: In this document, outputs from the ABR device are referred to as "inputs" to the controller (PLC). Outputs from the controller (PLC) are referred to as "inputs" to the ABR device.

The ABR is PROFINET compatible but not PROFINET certified.

Note: To use PROFINET on an ABR 3000, the firmware should be version 1.5.5.707 or later.

Note: The GSD file is available for download at http://www.bannerengineering.com.

8.5.1 General Station Description (GSD) File

The General Station Description (GSD) file contains module information, such as:

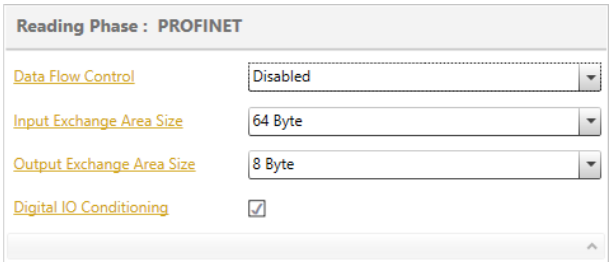
- Configuration data
- Data information (pass count, inspection status, etc.)
- Diagnostics

8.5.2 Configure the ABR

After PROFINET is added to a configuration's protocols (see Set the Compatible Industrial Ethernet Protocol (EtherNet/IP, MODBUS TCP, SLMP, PROFINET) on p. 46), there is an option to configure settings specific to this protocol.

1. Click **PROFINET** in the left side Configuration panel.
   The right side **Control** panel displays the PROFINET settings.
2. Use the default settings, unless the output strings sent by the ABR need to be longer than 63 characters.

Figure 122. PROFINET Settings in the Barcode Manager Software



Data Flow Control

When Enabled, communication requires handshaking control, but can use multiple 64 byte fragments to transmit larger messages. The default is Disabled.

[31] PROFINET® is a registered trademark of PROFIBUS Nutzerorganisation e.V.
[32] CC-A ensures that the device has the minimum properties regarding functionality and interoperability.

Input Exchange Area Size

The maximum amount of data the PLC can get from the ABR in one cycle. Because this setting must match the GSD file used, the default setting is recommended. The default is 64 Byte.

Output Exchange Area Size

The maximum amount of data the ABR can get from the PLC in one cycle. Because this setting must match the GSD file used, the default setting is recommended. The default is 8 Byte.

Digital IO Conditioning

When this checkbox is selected, the ABR is capable of exchanging 8 bits of both input and output data to be used for control such as reading phase triggers and output pulses. This data appears in the first byte of the input and output data, so the output data message string will start in the second byte when checked. The checkbox is selected by default.

8.5.3 Configuration Instructions

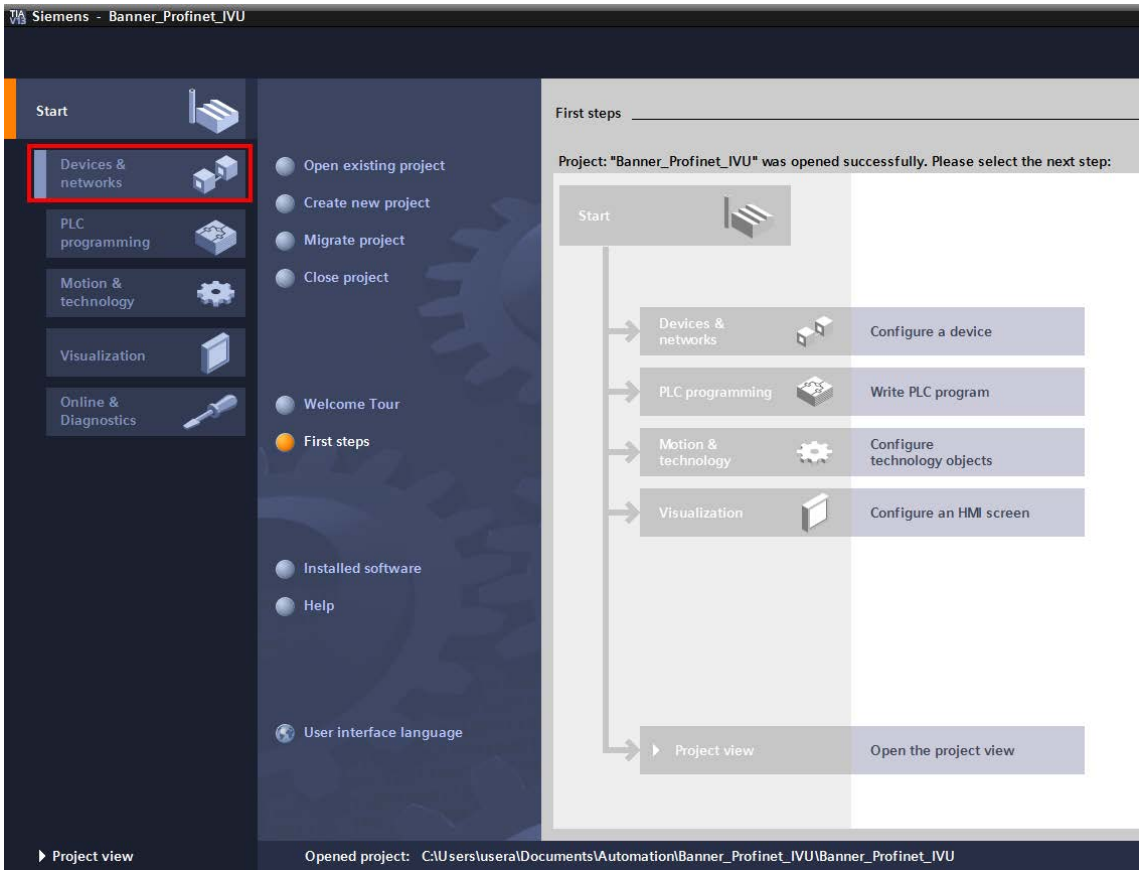
Using Siemens TIA Portal (v15) Software

Installing the GSD File

Use these instructions to install the GSD file in the Siemens TIA Portal (v15) software. Use these instructions as a basis for installing the GSD file in another controller (PLC).

1. Start the Siemens TIA Portal (v15) software.
2. Click **Open existing project**.
3. Select a project and open it.
4. Click **Devices & networks** after the project has been uploaded.

Figure 123. Devices and Networks



5. Click **Configure networks**.

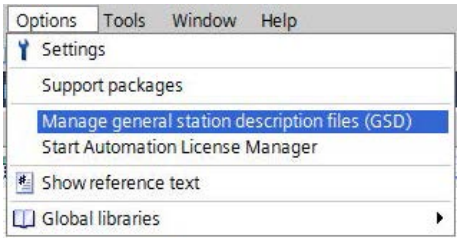
Figure 124. Configure Networks



Network view displays.

6. Click **Options** and select **Manage general station description file (GSD)**.

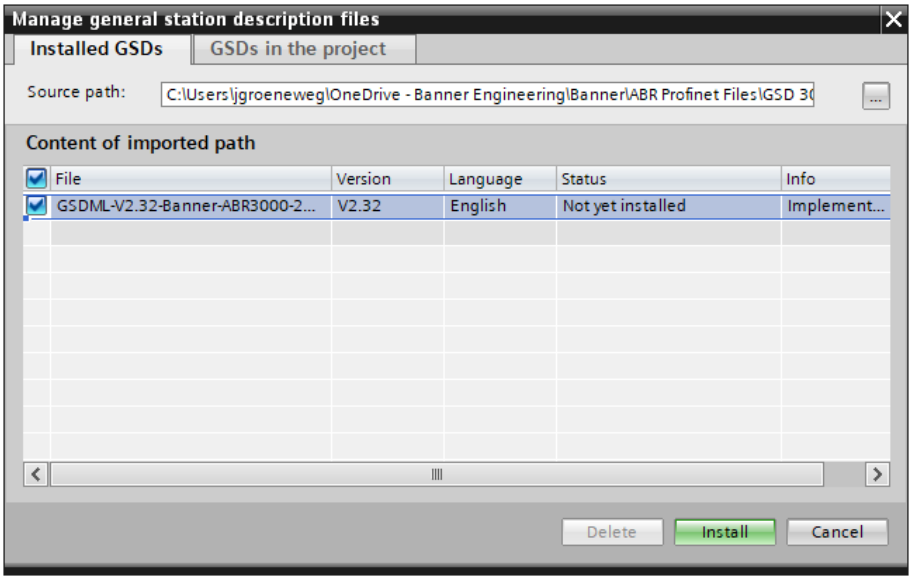
Figure 125. Options—Install the GSD



The **Install general station description file** window opens.

7. Click the browse button **(...)** to the right of the **Source path** field.

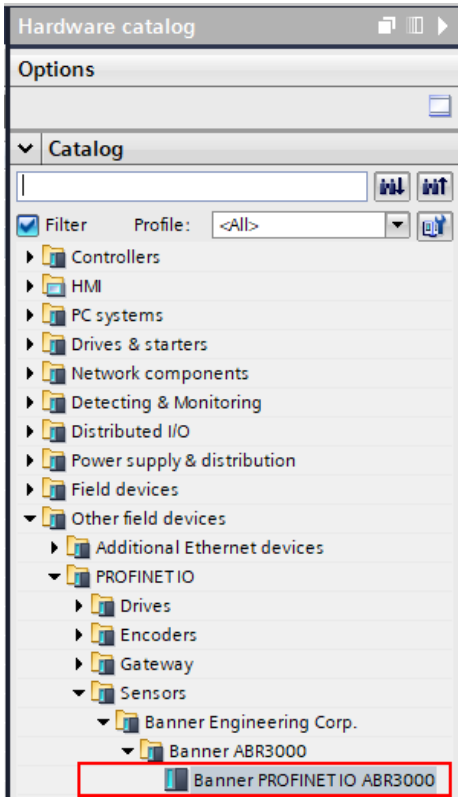
Figure 126. Manage GSD Files



8. Navigate to the location the ABR GSD file was downloaded to.

9. Select the ABR GSD file.
10. Click **Install**.

Figure 127. Hardware Catalog



11. Click **Close** when the install finishes.
12. Click **Devices & networks**.
    The system installs the ABR GSD file and places it in the **Hardware catalog**. In the above example, the ABR GSD file is located under **Other field devices** > **PROFINET IO** > **Sensors** > **Banner Engineering Corp.** > **Banner ABR3000** > **ABR3000**.

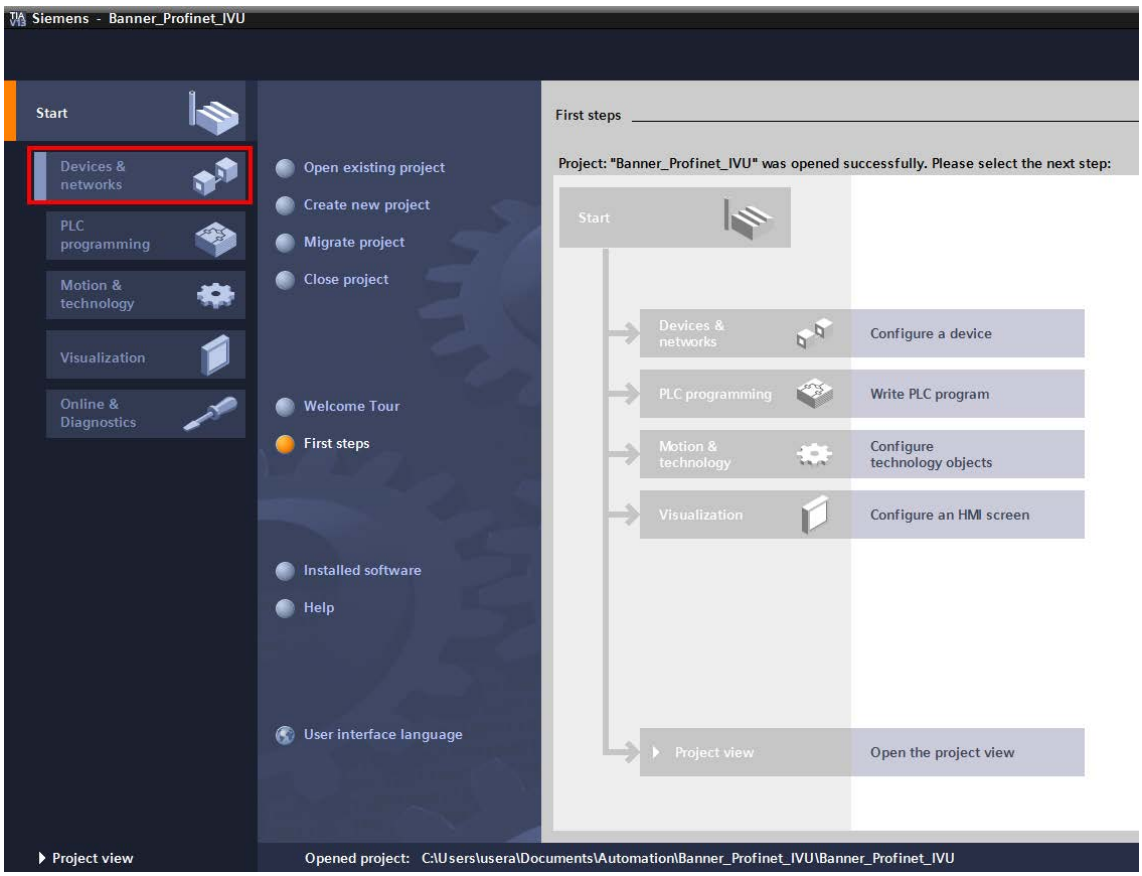
Note: If the ABR GSD file does not install properly, save the log and contact Banner.

Adding a Device to a Project

Use these instructions to add a ABR device to a Siemens TIA Portal (v15) project, and to configure the device. Use these instructions as a basis for adding a ABR device to another controller (PLC).

1. Start the Siemens TIA Portal (v15) software.
2. Click **Open existing project**.
3. Select a project and open it.
4. Click **Devices & networks** after the project has been uploaded.

Figure 128. Devices and Networks



5. Click **Configure networks**.

Figure 129. Configure Networks

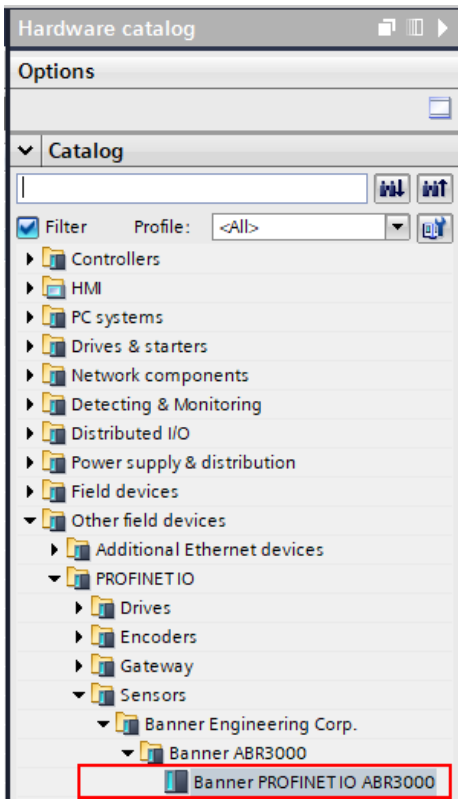


Network view displays.

Note: For Step 6 through Step 10, **Network view** must be open.

6. Locate the ABR in the **Hardware catalog**.

Figure 130. Hardware Catalog



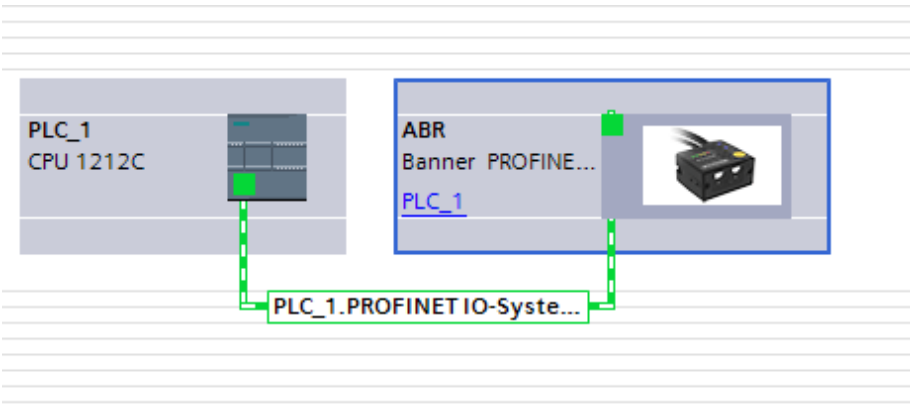
In the above example, the ABR device is located under **Other field devices** > **PROFINET IO** > **Sensors** > **Banner Engineering Corp** > **Banner ABR3000** > **ABR3000**.

7. Select the device and add it to the configuration.

Selection Option	Description
Drag	Drag the ABR from the **Hardware catalog** directly into the configuration.
Double-click	Double-click on the ABR and add it to the configuration.

8. Click the green square on the ABR icon. Drag the pointer to the green square on the PLC_1 icon to connect the device to the controller (PLC).

Figure 131. Drag to Connect



The connection is made.

9. Double-click the ABR icon to open the **Device** window.
10. Select the desired modules or submodules from the **Hardware catalog** and drag them onto the **Device overview** tab on the **Device view** tab.

    If the PROFINET settings in Barcode Manager are left at default, then these modules do not need to be configured; the default settings will match.

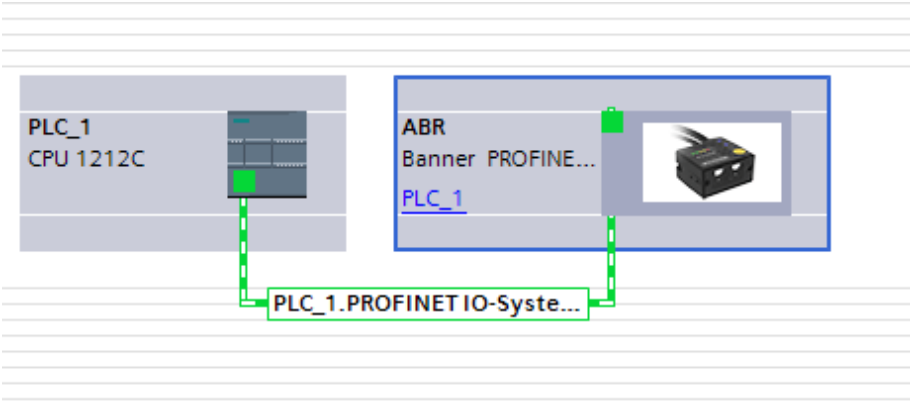
The ABR device is configured.

Changing the Device IP Address

Use these instructions to change the IP address of the ABR device, using the Siemens TIA Portal (v15) software. Use these instructions as a basis if you are using another controller (PLC).

1. Start the Siemens TIA Portal (v15) software.
2. Click **Open existing project**.
3. Select a project an open it.
4. Click **Devices & networks** after the project has been uploaded to go to **Network view**.

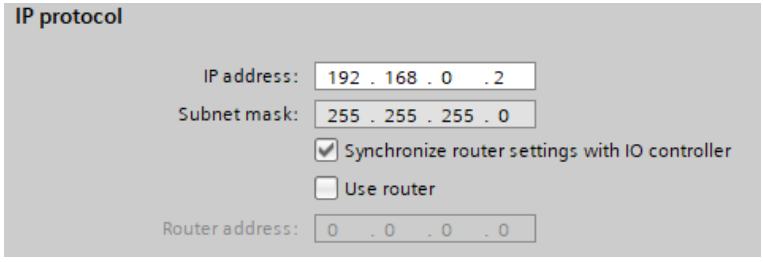
Figure 132. Network View



Network View displays.

5. Double-click on the ABR icon to open the **Device view**.
6. Click on the ABR icon in the graphic area of the **Device view** to open the **Module properties** window. The module can now be configured.
7. Click **Properties**.
8. Click **General**.
9. Select **PROFINET interface**. The project sets the IP address of the device.
10. Enter the IP address.

Figure 133. Set IP Address



11. Right-click on the device icon and select **Online & diagnostics**.

Figure 134. Select Online & Diagnostics

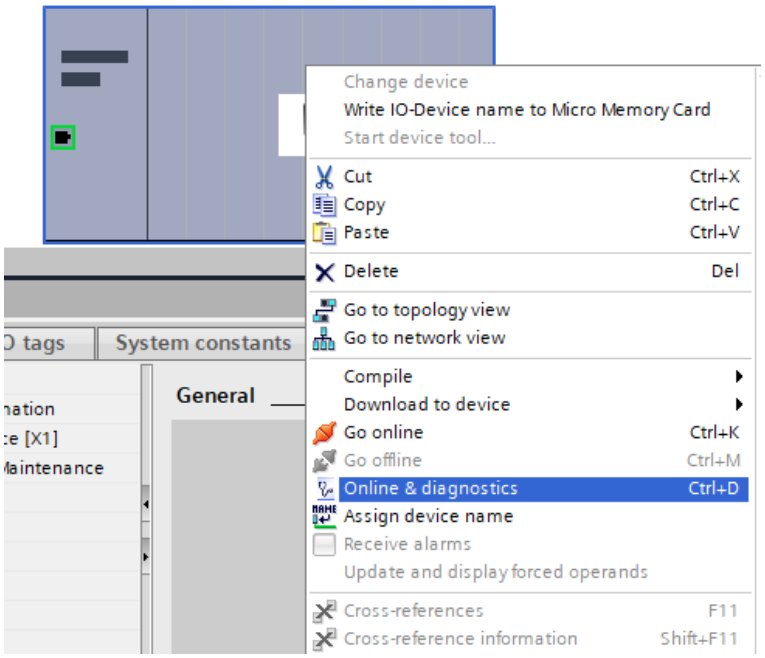
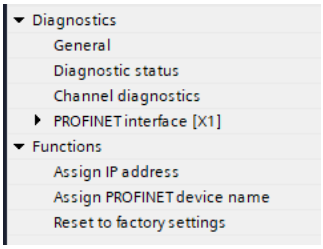


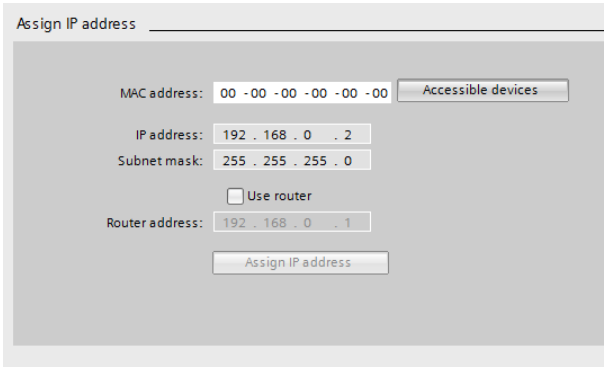
Figure 135. Online & Diagnostics



The **Online & diagnostics** window displays.

12. Select **Assign IP address** under **Functions**.
13. Click **Accessible devices**.

Figure 136. Assign IP Address—Accessible Devices

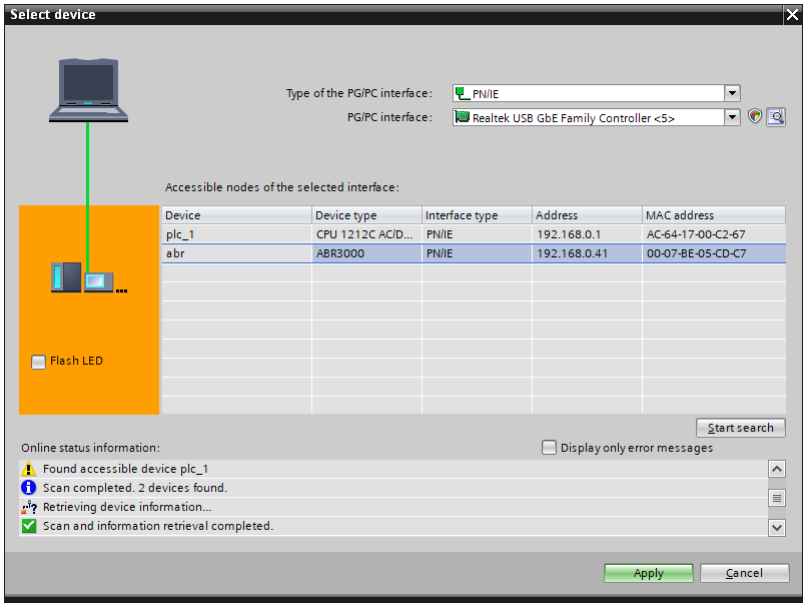


The **Select device** window searches the network for available devices.

14. Determine the device to be adjusted via the MAC address and select it.

    Use the Barcode Manager software to verify the MAC address: **Getting Started** > **Sensor Neighborhood**.
15. Click **Apply**.

Figure 137. Select the Device and Apply Changes



The IP address for the device is updated.

16. Click **Assign IP address** to complete the step.

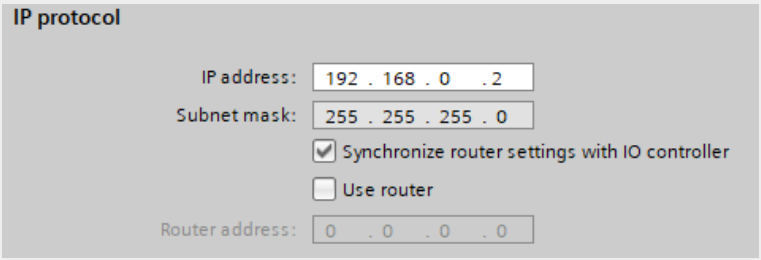
    This step is completed for every device.

Note: PROFINET devices commonly lack an IP address on startup (IP address = all zeros). However, ABR devices require an IP address to connect to Barcode Manager to set the device configuration.

By default, each Banner device shipped from the factory is assigned the IP address 192.168.3.100. The default address can be changed using Barcode Manager.

Immediately after the PROFINET protocol has been enabled in the Banner device, but before the PLC discovers and connects to the Banner device, the Banner device will retain its IP address. After the PLC discovers and connects to the Banner device, the behavior of the IP address depends on the state of the PLC.

Figure 138. Siemens TIA Portal (v15): IP Protocol Options



The PLC assigns the Banner device IP address, but only after the program has been loaded into the PLC and is running.

If the Banner device is restarted after it was discovered and configured by the PLC, the Banner device has an IP address of 0.0.0.0 until the PLC discovers it and assigns it the specified address again.

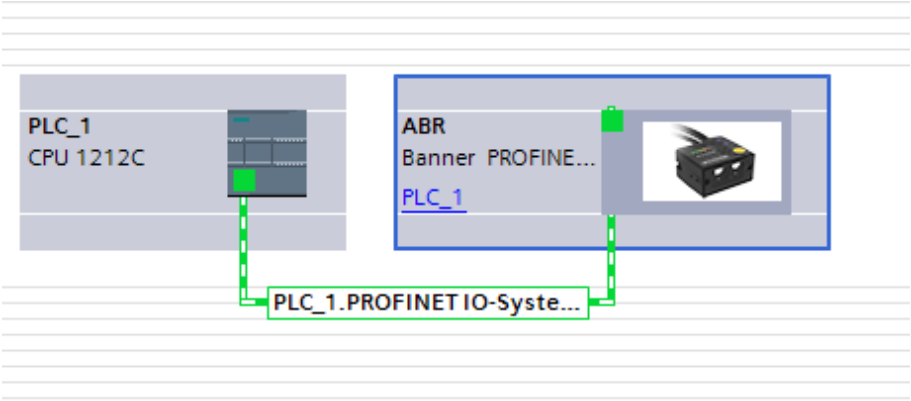
When the Banner device has no IP address assigned, it is still possible to assign an IP address to the Banner device using Barcode Manager. However, if this address is different than what is specified in the PLC, the Banner device reverts to the address specified in the PLC when the PLC becomes active again.

Changing the Device Name

Use these instructions to change the name of the ABR device, using the Siemens TIA Portal (v15) software. Use these instructions as a basis if you are using another controller (PLC).

1. Open a project and click on **Devices & networks** to go to the **Network view**.

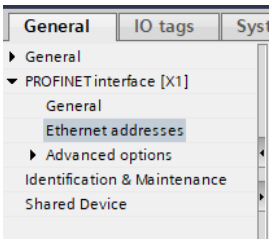
Figure 139. Network View



Network view displays.

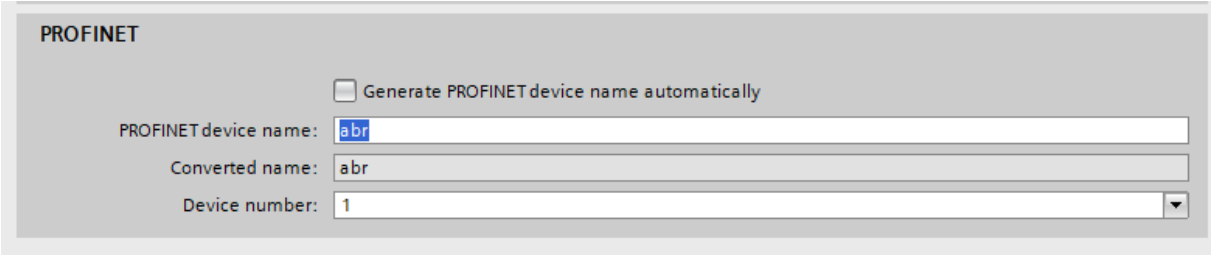
2. Double-click on the ABR icon to open **Device view**.
3. Click on the ABR icon in the graphic area of **Device view** to open the **Module properties** window.
4. Click **General**.
5. Select **PROFINET interface [X1]** > **Ethernet addresses**.

Figure 140. Ethernet Addresses



6. Deselect **Generate PROFINET device name automatically**.

Figure 141. PROFINET Device Name



7. Enter a unique name in the **PROFINET device name** field.

   This must match the ABR Device Name configured in the Barcode Manager software, which is ABR by default. This can be changed in the Barcode Manager software under **Device** > **Settings** > **Settings**.
8. Enter a unique device number in the **Device number** field.

Note: Each device number is used only once.

9. Right-click on the device icon and select **Online & diagnostics**.

Figure 142. Select Online & Diagnostics

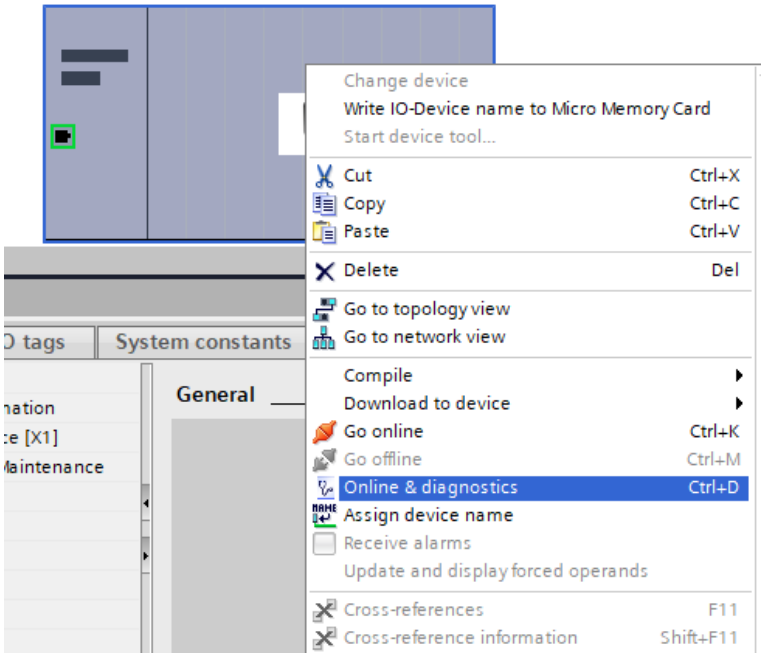
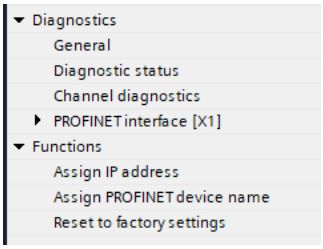


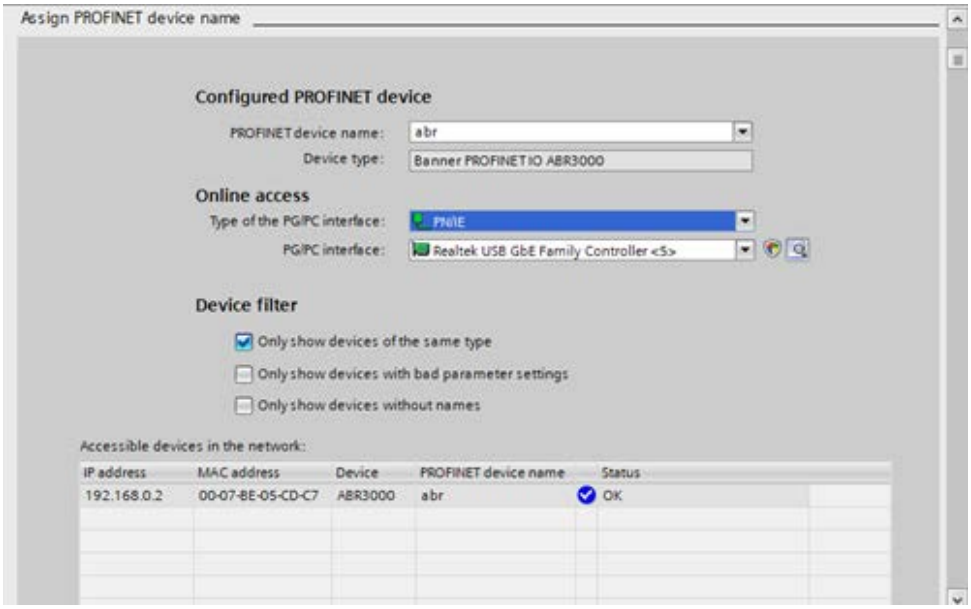
Figure 143. Online & Diagnostics



The **Online & diagnostics** window displays.

10. Select **Assign PROFINET device name** under **Functions**.
    The **Assign PROFINET device name** window displays. The devices in the network are discovered.
11. Select the device that will have a name assigned to it.
12. Click **Assign name** to start the process.
    The name is assigned.

Figure 144. Assign Name



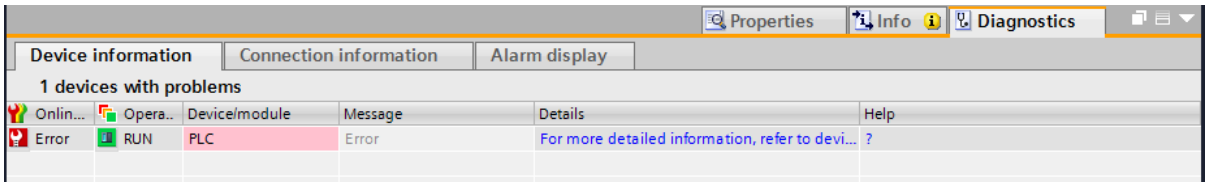
The project can be downloaded to the PLC to test the connection and check for errors.

8.5.4 Diagnosing Errors

The Siemens TIA Portal (v15) software includes numerous diagnostic tools. When a computer is connected to the controller (PLC), diagnostic information is available. The controller (PLC) generates a message that displays in the **Diagnostics** window. A flashing red light on the CPU module of the controller (PLC) indicates an error.

1. Click on the text in the **Details** column to request detailed information about the device that caused the error.

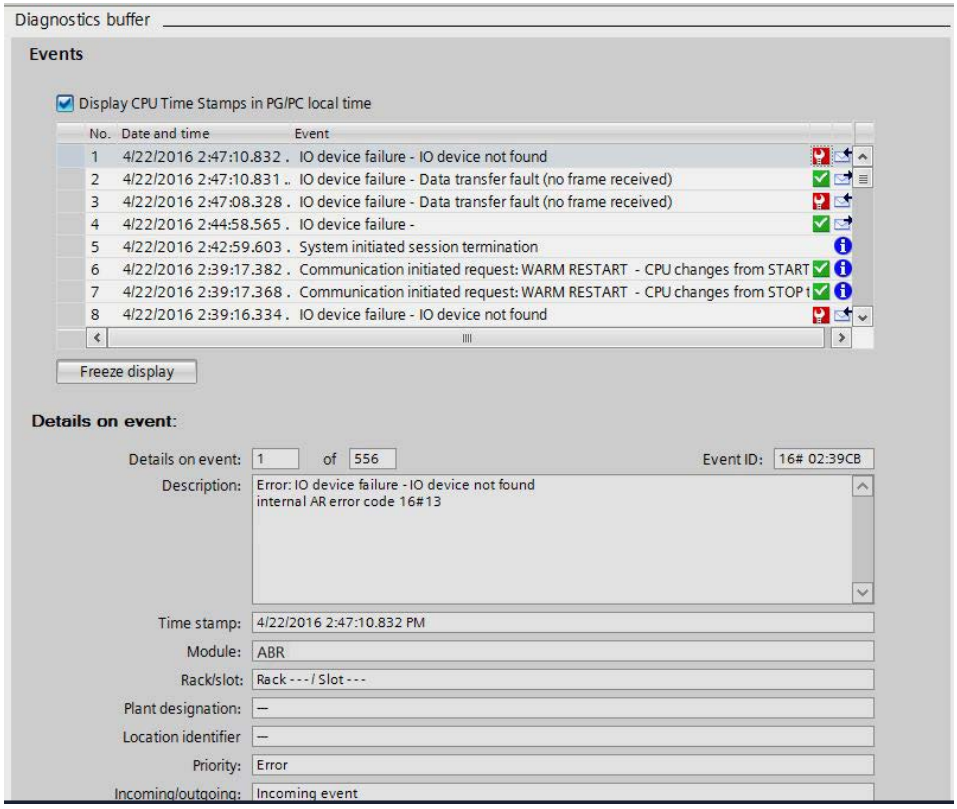
Figure 145. Diagnostics



All system and device messages are displayed in the **Diagnostics buffer** window under **Events** and **Details on event**.

2. Select a message in the table, **Display CPU Time Stamps in PG/PC local time**.

Figure 146. Diagnostics Buffer



The respective information displays in the **Description** field under **Details on event**.

3. Read the message to learn about the error and resolve it. When the error is resolved, the icon that corresponds to the displayed message is green.

8.5.5 PROFINET® Data Map

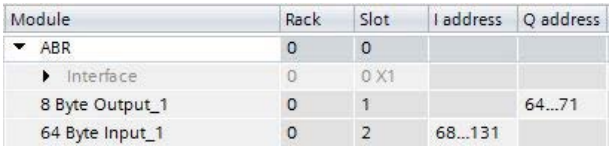
The addresses used in the PLC for ABR data will vary, but the order of the data will not. Use this example to learn how to find the ABR data in the PLC.

1. Open **Device & Networks**.
2. Select the desired ABR.

3. Select the **Device View** tab.

The **Device Overview** tab shows how the ABR is mapped to the local memory of the PLC. In the example shown, the input data is stored in I68 through I131. This is a total of 64 bytes worth of data. It may be necessary to change the size of slots 1 and 2. Make sure these match the ABR PROFINET settings in Barcode Manager.

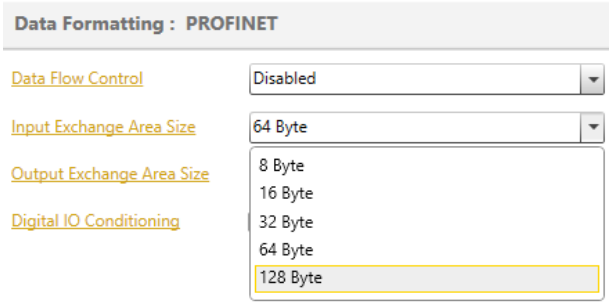
Figure 147. ABR addresses in PLC memory, with default sizes



WARNING: If using an S7-300 PLC, such as model number CPU315-2 PN/DP, you may need to change the I and Q addresses to different values than the default values to make sure they are valid memory locations. The I and Q area is only 128 bytes by default. See Banner tech note *S7-300 and the ABR* for more details.

The following is an example of when to change the default settings: If you want to read a 70-character long barcode and transmit the whole contents to the PLC. To do this, change the Input Exchange Area Size to the maximum, which is 128 bytes. In this case, if the default size of 64 bytes is used, the last few characters of a code this size are ignored.

Figure 148. Increasing the size of the data (optional)



If 128 bytes is not enough data, try using Data Flow Control to send the data in fragments. Contact Banner for more information.

The first byte of the input data and the first byte of the output data are used for the discrete Industrial Protocol bits. Industrial Protocol bits are user-defined to perform functions like triggers and pass/fail outputs. Using default data size settings and the PLC addresses shown in Figure 147 on p. 93, the PLC data map looks like this:

PLC byte address	PLC bit	ABR Function
Q64	Q64.0	PROFINET Output Bit 0
	Q64.1	PROFINET Output Bit 1
	Q64.2	PROFINET Output Bit 2
	Q64.3	PROFINET Output Bit 3
	Q64.4	PROFINET Output Bit 4
	Q64.5	PROFINET Output Bit 5
	Q64.6	PROFINET Output Bit 6
	Q64.7	PROFINET Output Bit 7
Q65-Q71		Data Flow Control (optional)
I68 [33]	I68.0	PROFINET Input Bit 0
	I68.1	PROFINET Input Bit 1
	I68.2	PROFINET Input Bit 2
	I68.3	PROFINET Input Bit 3

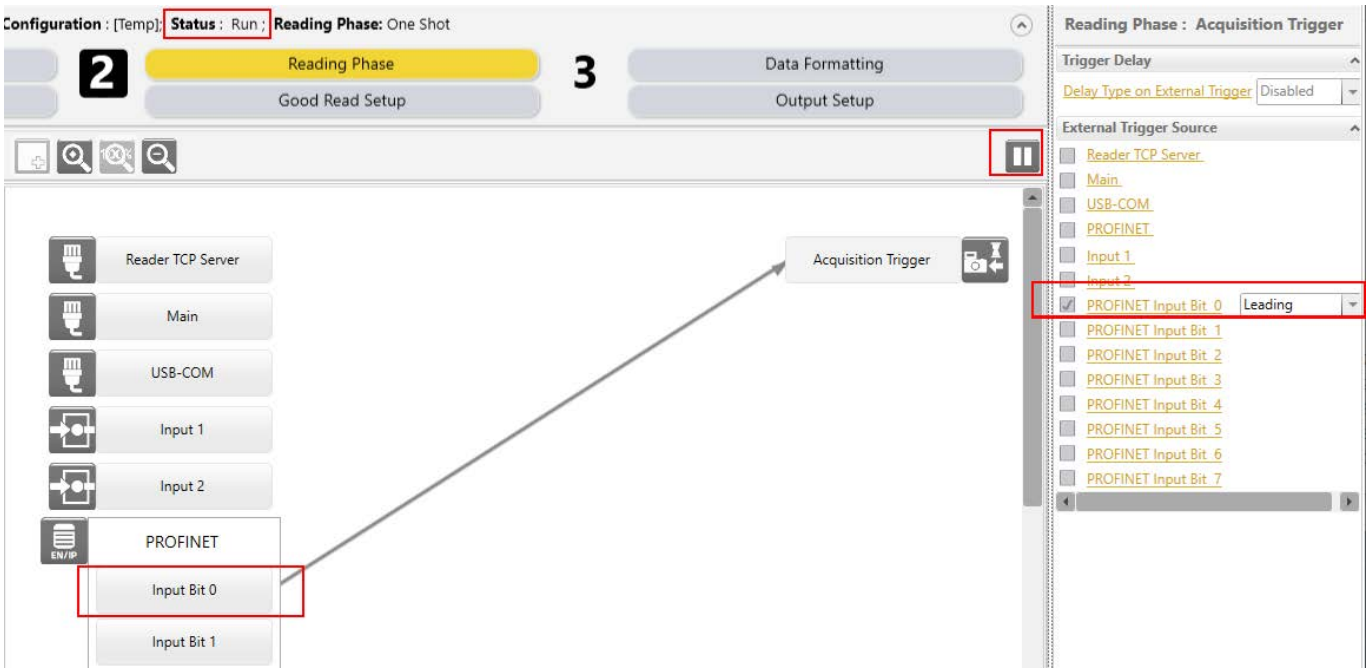
[33] If the Digital IO Conditioning setting in Barcode Manager PROFINET settings is disabled, then the input and output bits are not used, and barcode data messages moves up a byte to start at I68.

PLC byte address	PLC bit	ABR Function
	I68.4	PROFINET Input Bit 4
	I68.5	PROFINET Input Bit 5
	I68.6	PROFINET Input Bit 6
	I68.7	PROFINET Input Bit 7
I69-I131 [33]		Barcode Data Messages

The following shows how the input bits are used:

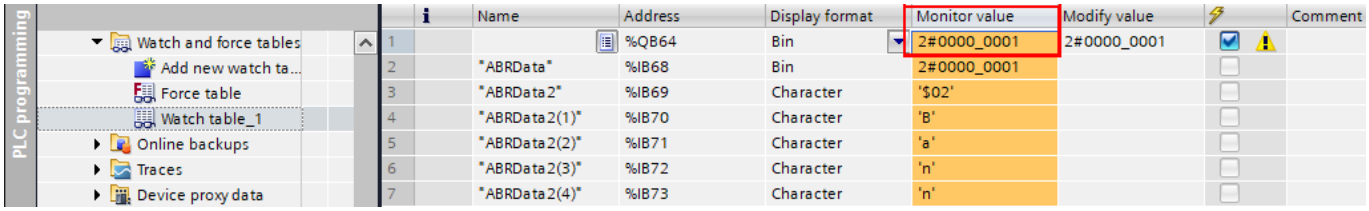
1. Set the One Shot Mode Acquisition Trigger to Bit 0 = Leading.
2. Make sure the ABR is in Run mode.

Figure 149. ABR Trigger Setup



3. Open a Watch table in TIA Portal.
4. Set Q64.0 to 1 to trigger the ABR.

Figure 150. Toggling Trigger Bit



For detailed information, see Industrial Ethernet Reading Phase Control on p. 46.

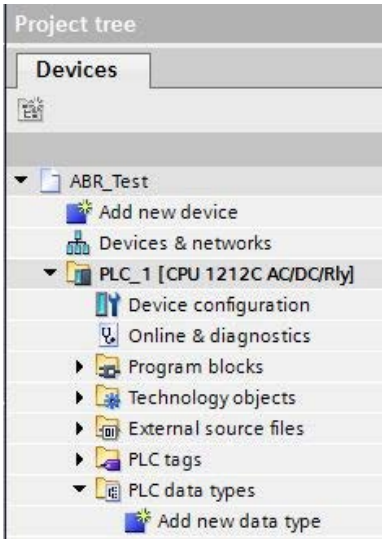
8.5.6 Monitoring ABR Barcode Data as a String

This example shows how to convert barcode data to a readable string of text. It assumes that the input size is 64 bytes, IO Conditioning is unchecked, and Data Flow Control is Disabled.

The ABR mapping in the PLC is as in Figure 147 on p. 93.

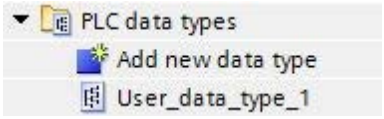
1. Create a custom PLC data type.
   a) On the **Project Tree**, under **Devices**, double-click **Add new data type**.

Figure 151. Add New PLC Data Type



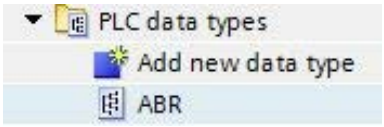
A generic "User data type" is created.

Figure 152. User Data Type



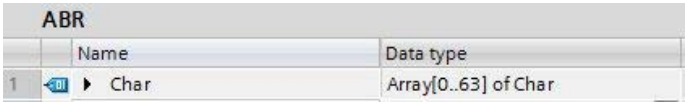
b) Rename the "User data type" as desired.
In this example, the name is set to `ABR`.

Figure 153. Rename User Data Type



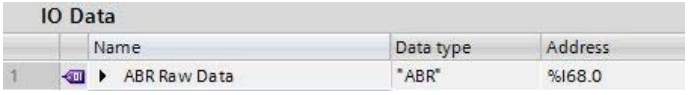
2. Double-click on **ABR**.
The configuration window opens.
3. Create an array of 64 characters.

Figure 154. 64 Character Array



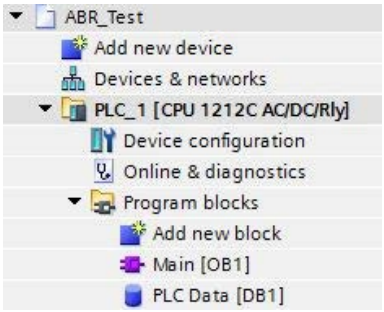
4. Next create a new PLC tag.
5. Add this tag to a new or existing table.

Figure 155. PLC Data Tag in a Table



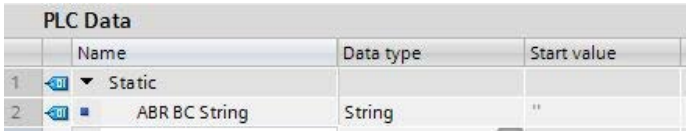
6. Create a data block that will be used to store a string.
In this example, the PLC Data was created.

Figure 156. PLC Data



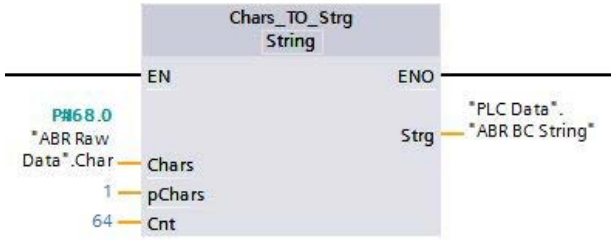
7. Add a string type tag to the data block.

Figure 157. Data Type = String



8. Add a Chars to Strg command; this will convert the raw data into a string.

Figure 158. Chars_TO_Strng



- Chars has the raw data tag created linked to it.
- pChars tells the block the first raw data element it should start at. The example shows to start at element 1. In the normal setup the first byte stores communications information which should be ignored.
- Cnt is the maximum value of the data being sent. Sixty-four bytes of data in this example.
- Strg is linked to the tag in the data block.

The conversion of raw data to string is complete at this point.

9 Reading Features

9.1 FOV Calculation

Use the data in the following table to calculate the Field of View (FOV) for your application. Refer to Figure 159 on p. 97 and the formula below.

Table 15: 3000 Models

Model	Offset Distance (d_0) (mm)	Horizontal Viewing Angle	Vertical Viewing Angle	Diagonal Viewing Angle	Min Reading Distance (mm)
ABR3009-xxxx (WVGA)	8	39°	26°	46°	25
ABR3106-xxxx (1.2 MP)	8	52°	40°	63°	30

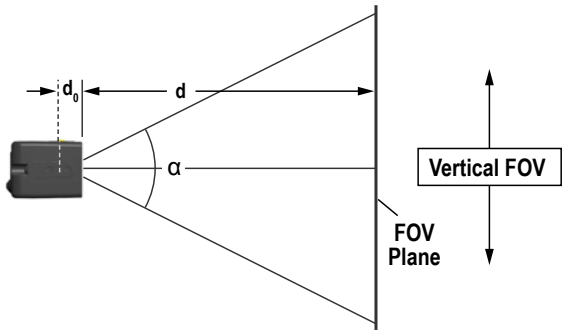
The viewing angle has a tolerance of ±1° depending on the reading distance.

$FOV_x = 2\,[(d + d_0)\tan(\alpha_x/2)]$

where:

FOV_x = horizontal, vertical or diagonal field of view (FOV)
α_x = horizontal, vertical or diagonal viewing angles
d = reading distance (in mm) from window surface to code surface
d_0 = offset distance (in mm) from center of lens to external window surface

Figure 159. Reading Distance References



Examples

The FOV for a ABR3106-WSE2 at a reading distance of 100 mm is:

$FOV_H = 2\,[(100\text{ mm} + 8\text{ mm})\tan(41°/2)] \approx 81\text{ mm}$

$FOV_V = 2\,[(100\text{ mm} + 8\text{ mm})\tan(32°/2)] \approx 62\text{ mm}$

9.2 Global FOV Diagrams

Note: The following diagrams are given for typical performance at 25° C using high quality grade A symbols according to ISO/IEC 15416 (1D code) and ISO/IEC 15415 (2D code) print quality test specifications. Testing should be performed with actual application codes in order to maximize the application performance.

The following diagrams show the maximum obtainable Field of View for 1D and 2D codes using Processing Mode = Advanced. Depending on the code resolution, symbology, and number of characters in the code, the Reading Area can be different from the FOV.

See the reference Reading Diagrams for specific reading area examples.

9.2.1 ABR3009-xxxx WVGA Models

Figure 160. Global FOV 1D Code Diagram for WVGA Models

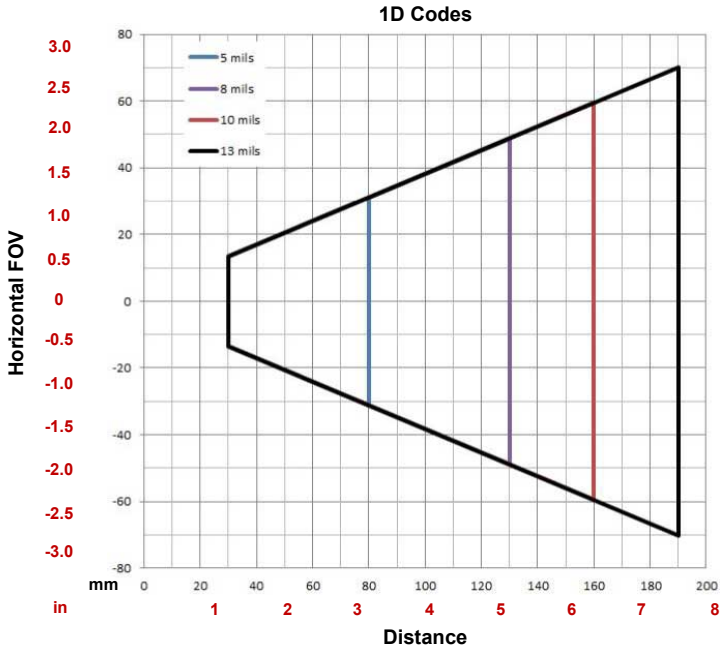
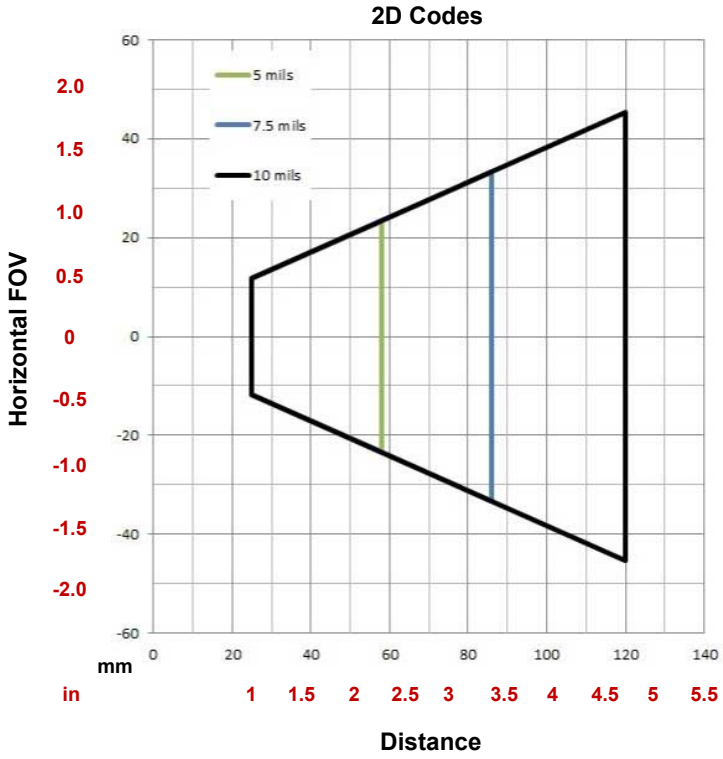


Figure 161. Global FOV 2D Code Diagram for WVGA Models



9.2.2 ABR3106-xxxx 1.2 MP Models

Figure 162. Global FOV 1D Code Diagram for 1.2 MP Models

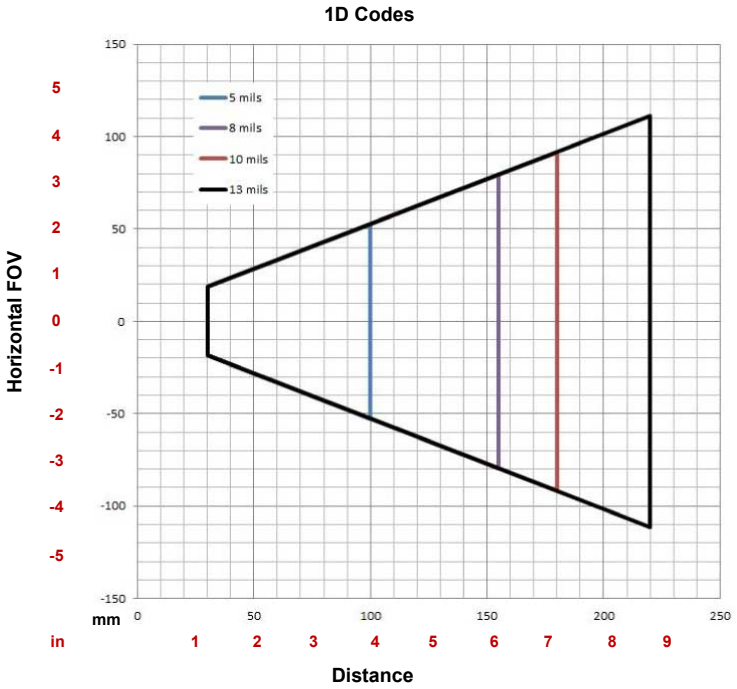
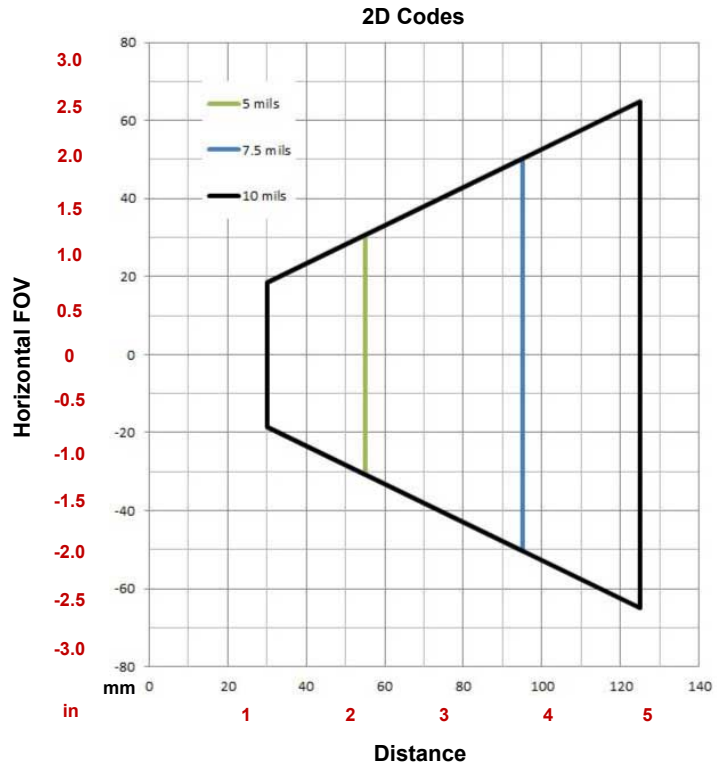


Figure 163. Global FOV 2D Code Diagram for 1.2 MP Models



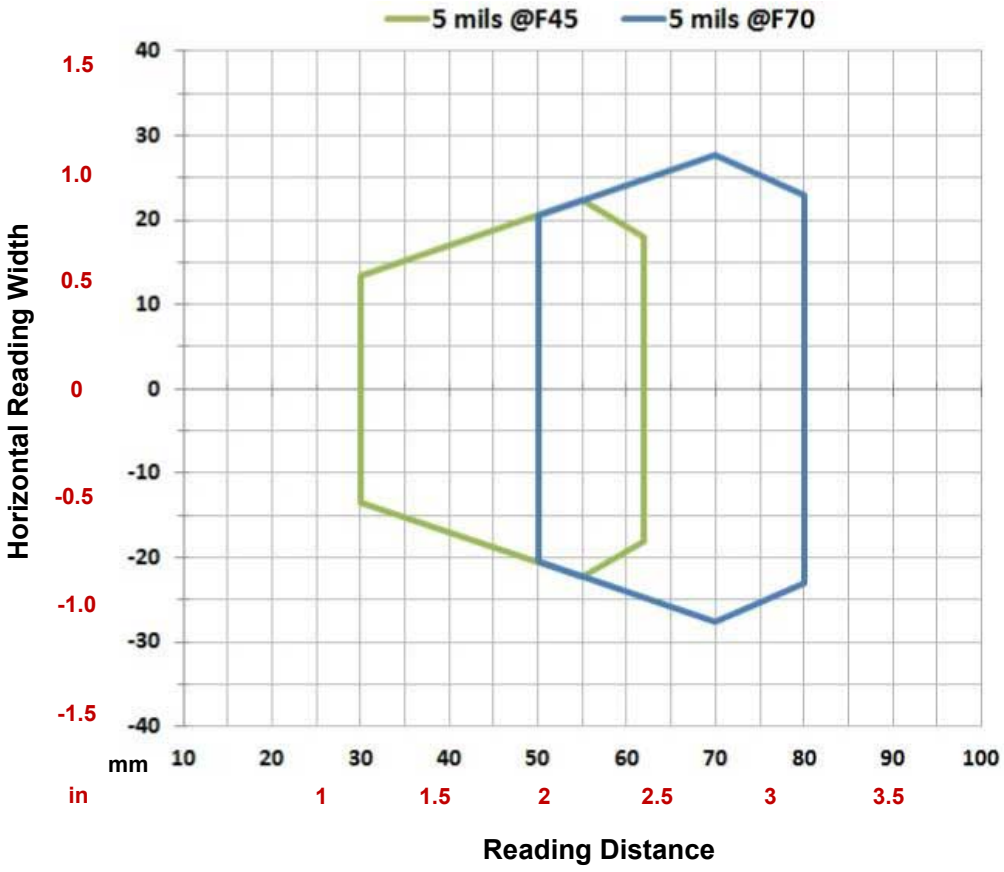
9.3 Reading Diagrams

- The following reading diagrams are references and are provided for typical performance at 25 °C using high quality grade A symbols: Code 128 (1D code) and Data Matrix ECC 200 (2D code).
- Perform testing with the actual ABR using application-specific codes to evaluate whether maximizing application performance requires adjustments to the hardware/software configuration with respect to the Reference Conditions given under each diagram
- The ratio of the Vertical FOV width with respect to the Horizontal FOV width in the diagrams depends on the model
  - For WVGA models, it is about equal to 0.64; specifically 480/752 (that is, $FOV_V \approx FOV_H \times 0.64$)
  - For 1.2 MP models, is about equal to 0.75; specifically 960/1280 (that is, $FOV_V \approx FOV_H \times 0.75$)
- The reading distance ranges are measured from the reading window surface
- The max theoretical Line Speed values for each diagram can be calculated using the formula in Maximum Line Speed and Exposure Calculations on p. 121
- Common software parameter settings:
  - For all ABR 3000 models (except where specified differently) reading all 1D code symbologies - Processing Mode = Standard
  - For all ABR 3000 models (except where specified differently) reading 2D code symbologies - Processing Mode = Standard; Code Contrast = Low; Decoding Complexity = Medium
- When defining a hardware/software configuration for the ABR for conditions different from those of the reference diagrams, keep in mind the following rules:
  - Changes in Exposure Time act directly proportional to the luminosity of the image and inversely proportional to the maximum code reading movement speed. Consequently, reducing the Exposure Time by half, reduces the luminosity of the image by half but doubles the theoretical code reading movement speed
  - Changes in Gain act directly proportional to the luminosity of the image. Increasing the Gain value however, can reduce the quality of the acquired image

9.3.1 ABR3009-xxxx WVGA Models 1D Codes

Code 128 0.12 mm (5 mils)

Figure 164. Code 128 0.12 mm (5 mils)

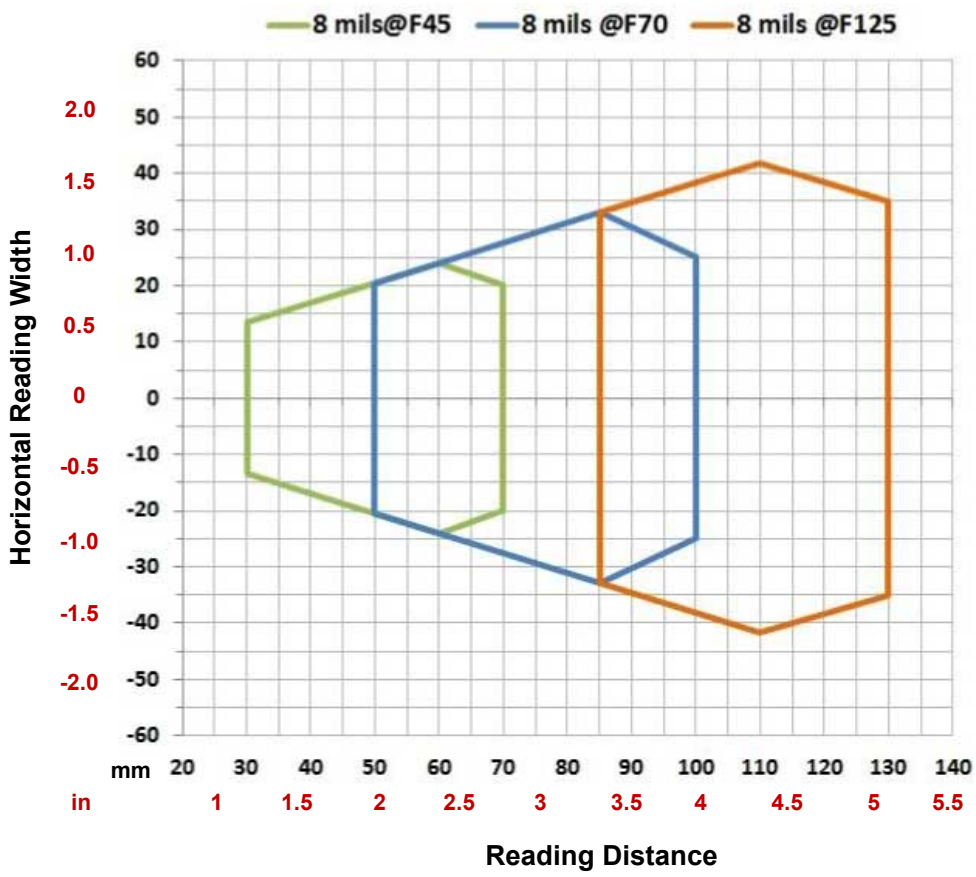


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.12 mm (5 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	70	

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	400	500	
Gain	10	15	

Code 128 0.20 mm (8 mils)

Figure 165. Code 128 0.20 mm (8 mils)

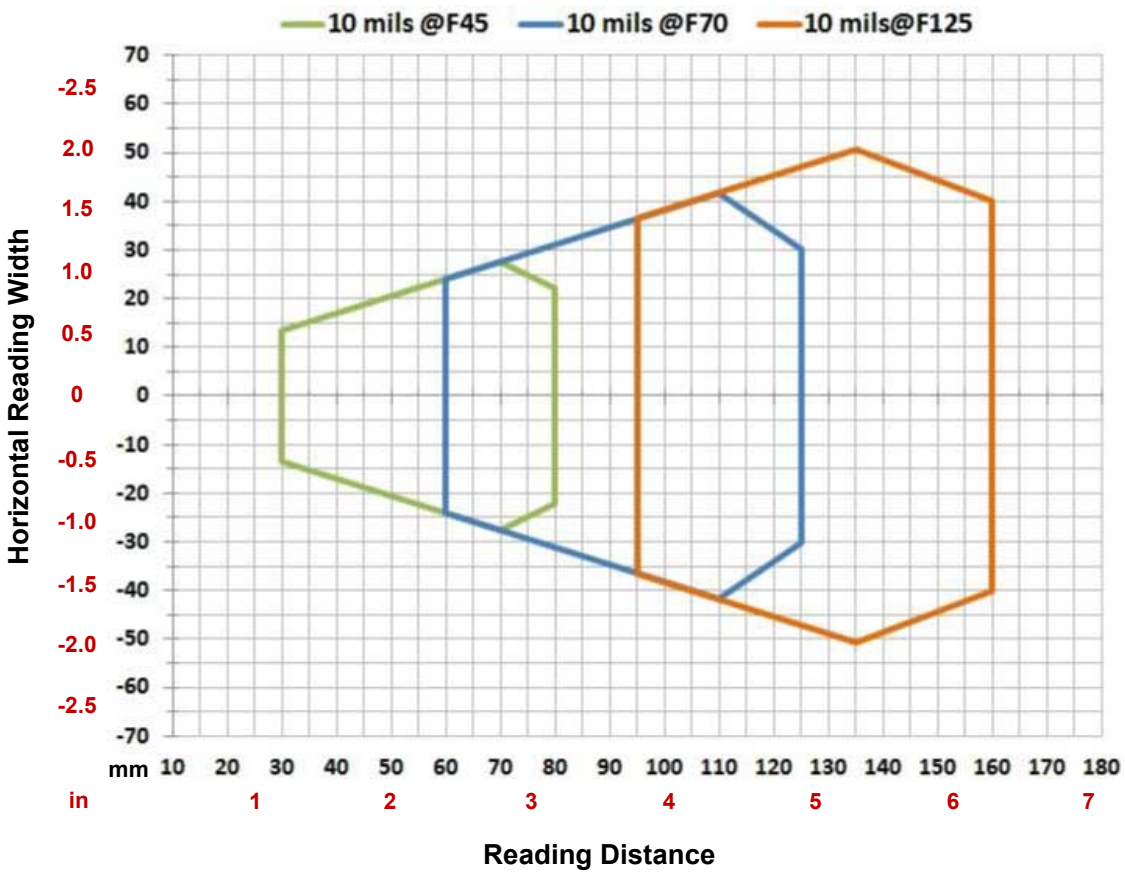


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.20 mm (8 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	70	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	400	500	600
Gain	15	20	30

Code 128 0.25 mm (10 mils)

Figure 166. Code 128 0.25 mm (10 mils)

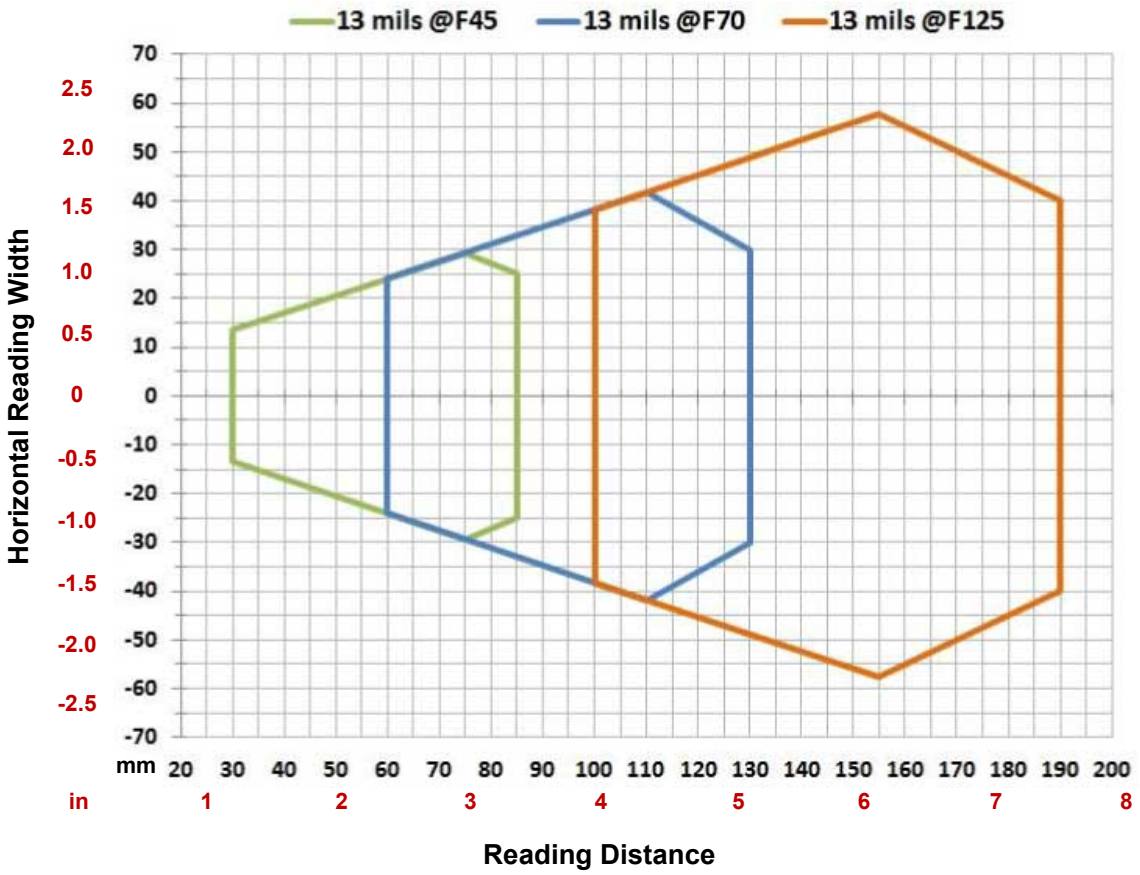


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.25 mm (10 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	70	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	500	700	800
Gain	10	20	32

Code 128 0.33 mm (13 mils)

Figure 167. Code 128 0.33 mm (13 mils)



Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.33 mm (13 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	70	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	400	600	800
Gain	10	20	32

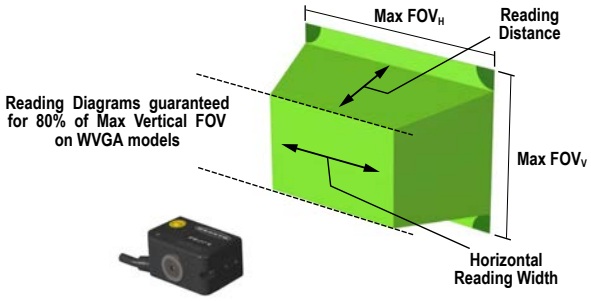
9.3.2 ABR3009-xxxx WVGA Models 2D Codes

Vignetting

For ABR 3000 models used in 2D code reading applications, due to the "fisheye" or “vignetting” effect of the lens, the reading area is limited to the central zone of the Vertical FOV.

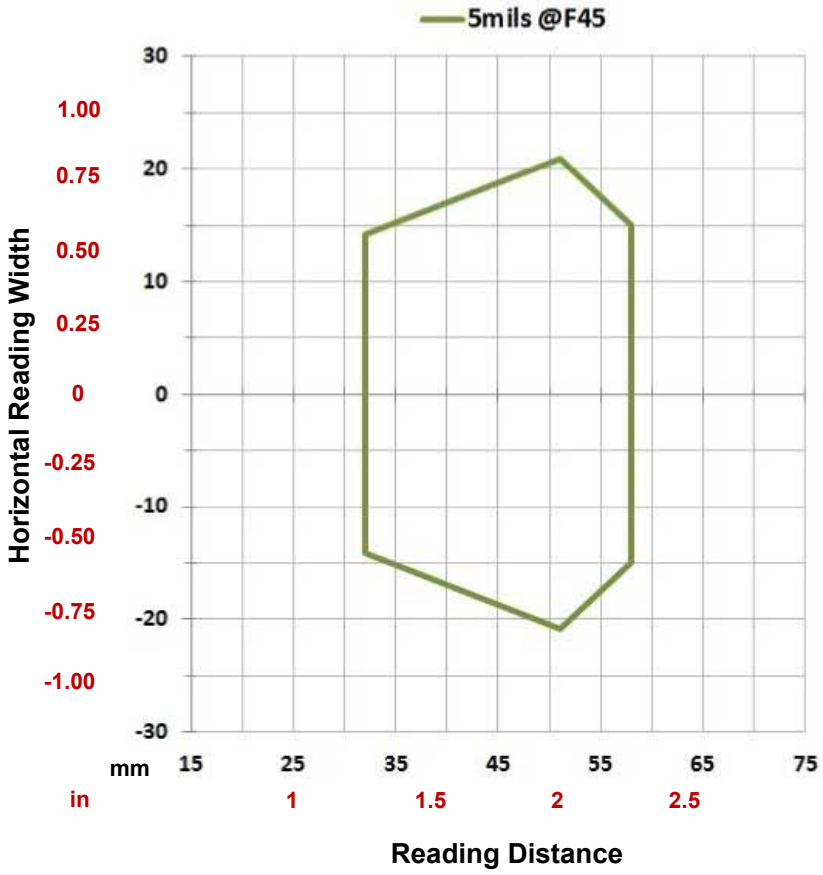
Depending on the application, Image Cropping can be applied above and below the central zone of the Vertical FOV, limiting image acquisition to the effective reading area and therefore increasing frame rate and reducing overall image processing time.

Figure 168. WVGA Model Vignetting Effect



Data Matrix 0.12 mm (5 mils)

Figure 169. Data Matrix 0.12 mm (5 mils)



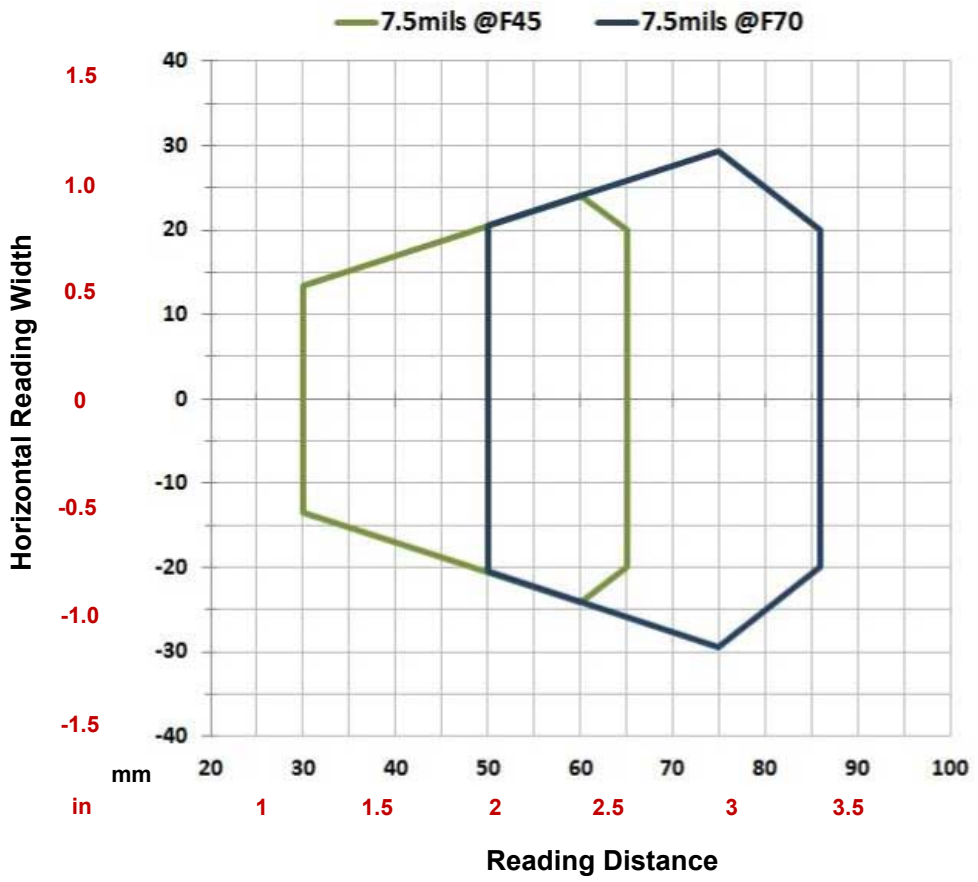
Hardware Settings	
Code Symbology	Data Matrix ECC 200
Code Resolution	0.12 mm (5 mils)
Tilt Angle	0°

Hardware Settings	
Skew Angle	15°
Focusing Distance (mm)	45

Software Parameters	
Illuminator Lighting	Very High Power Strobed
Exposure Time (µs)	450
Gain	5

Data Matrix 0.19 mm (7.5 mils)

Figure 170. Data Matrix 0.19 mm (7.5 mils)



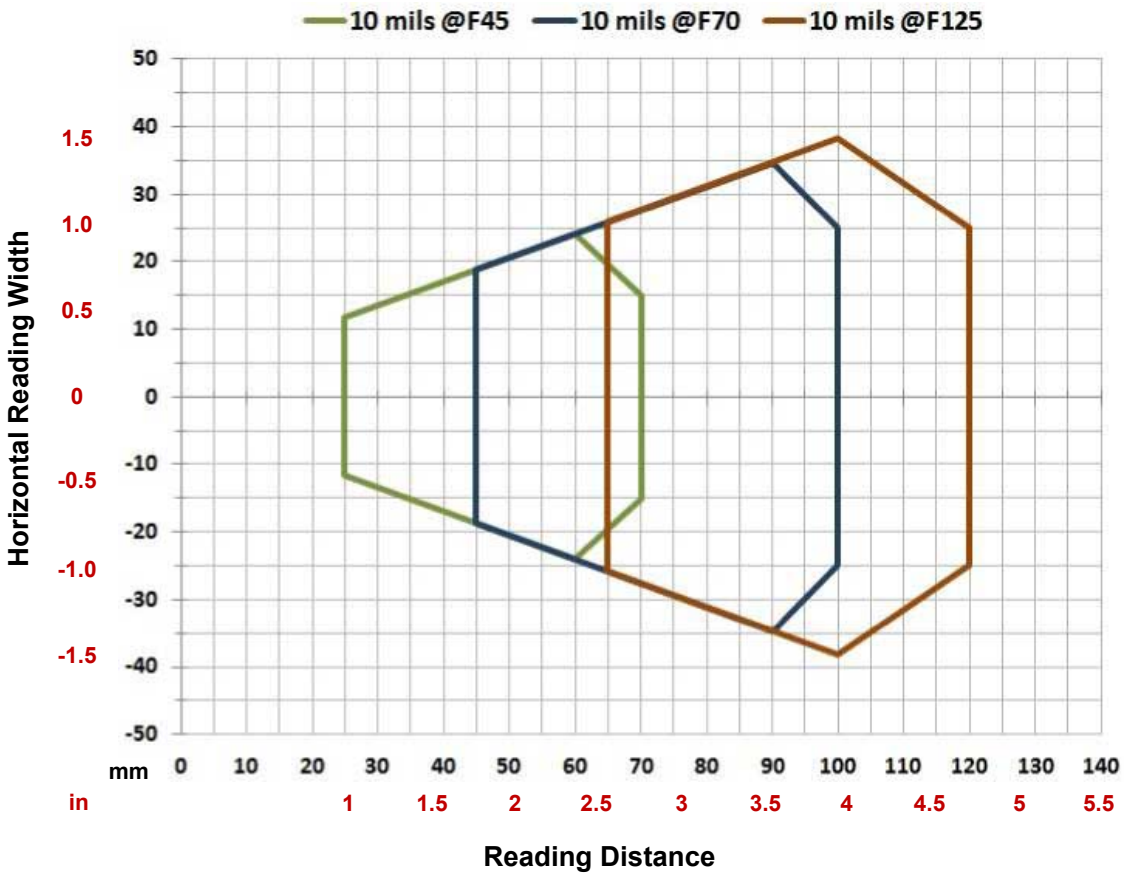
Hardware Settings		
Code Symbology	Data Matrix ECC 200	
Code Resolution	0.19 mm (7.5 mils)	
Tilt Angle	0°	
Skew Angle	15°	
Focusing Distance (mm)	45	70

Software Parameters		
Illuminator Lighting	Very High Power Strobed	
Exposure Time (µs)	450	500

Software Parameters		
Gain	5	10

Data Matrix 0.25 mm (10 mils)

Figure 171. Data Matrix 0.25 mm (10 mils)



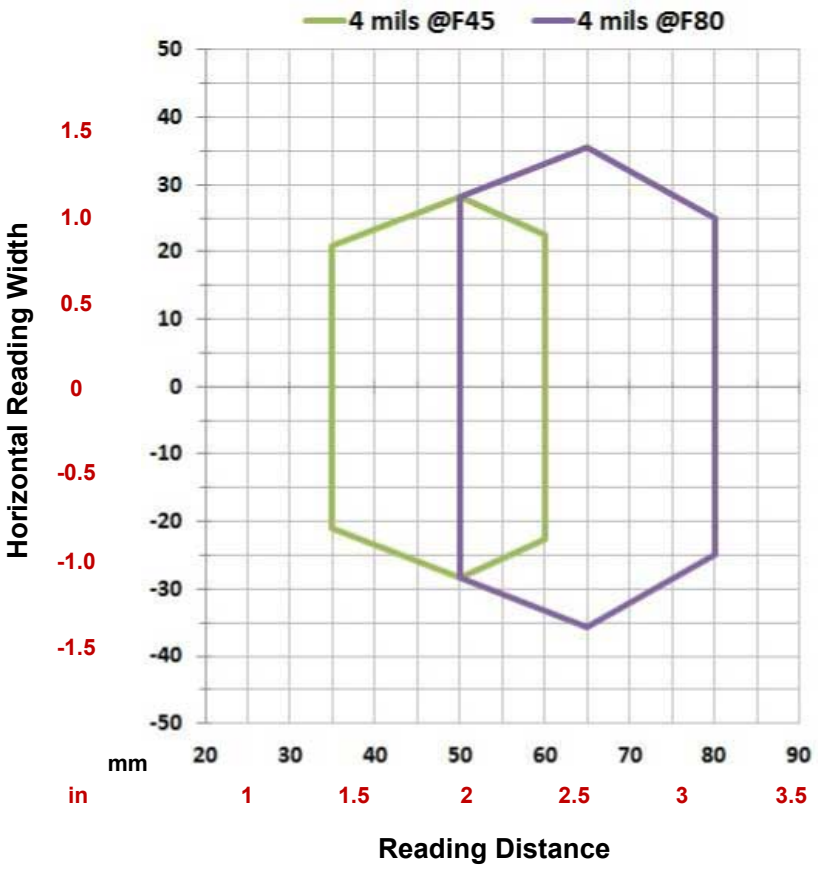
Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.25 mm (10 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	70	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	280	500	650
Gain	10	10	13

9.3.3 ABR3106-WSxx 1.2 MP Models 1D Codes

Code 128 0.10 mm (4 mils)

Figure 172. Code 128 0.10 mm (4 mils)

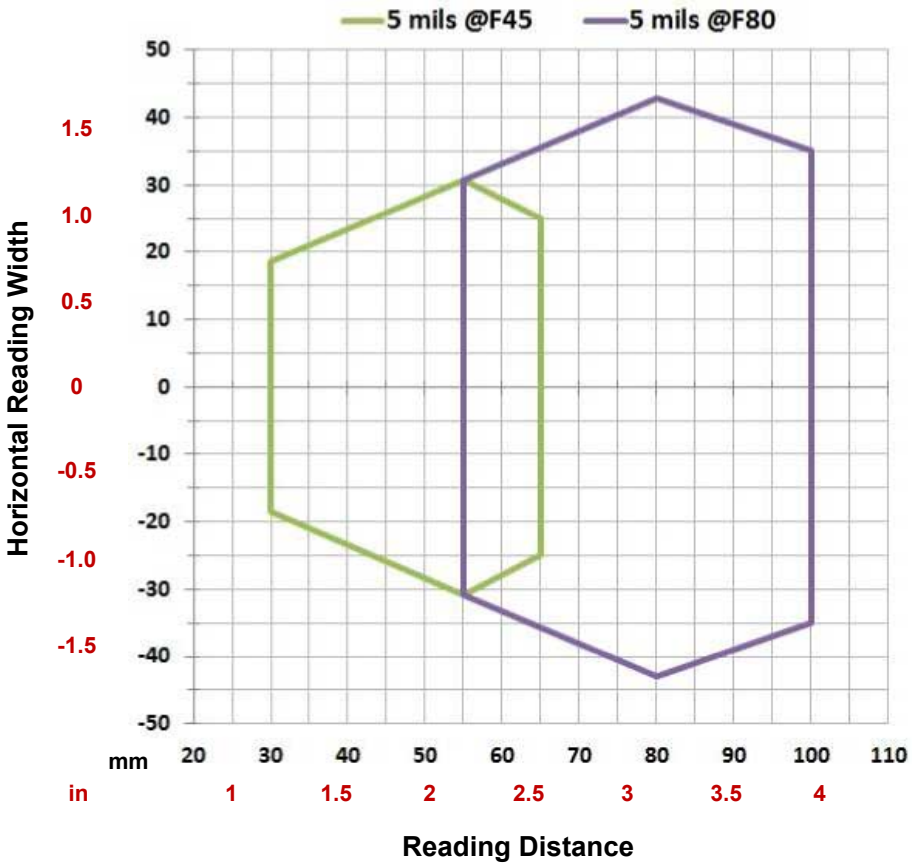


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.10 mm (4 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	80	

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	250	300	
Gain	10	15	

Code 128 0.12 mm (5 mils)

Figure 173. Code 128 0.12 mm (5 mils)

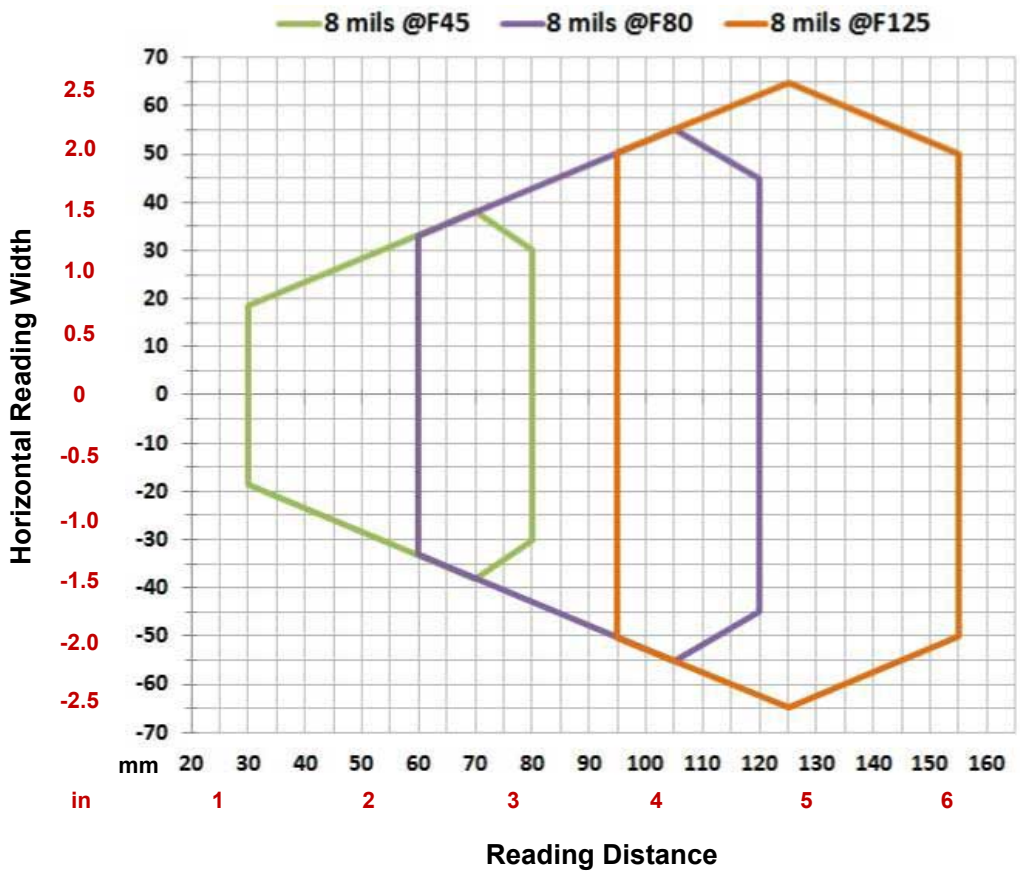


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.12 mm (5 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	80	

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	250	400	
Gain	10	12	

Code 128 0.20 mm (8 mils)

Figure 174. Code 128 0.20 mm (8 mils)

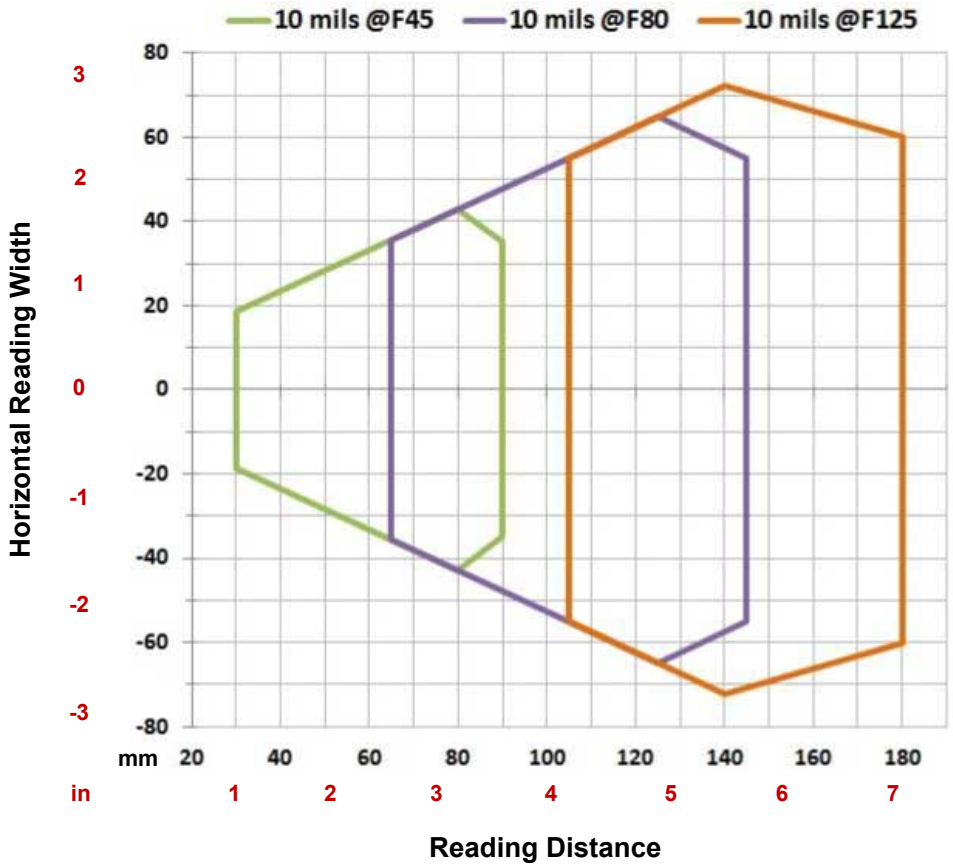


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.20 mm (8 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	80	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	300	400	600
Gain	10	20	25

Code 128 0.25 mm (10 mils)

Figure 175. Code 128 0.25 mm (10 mils)

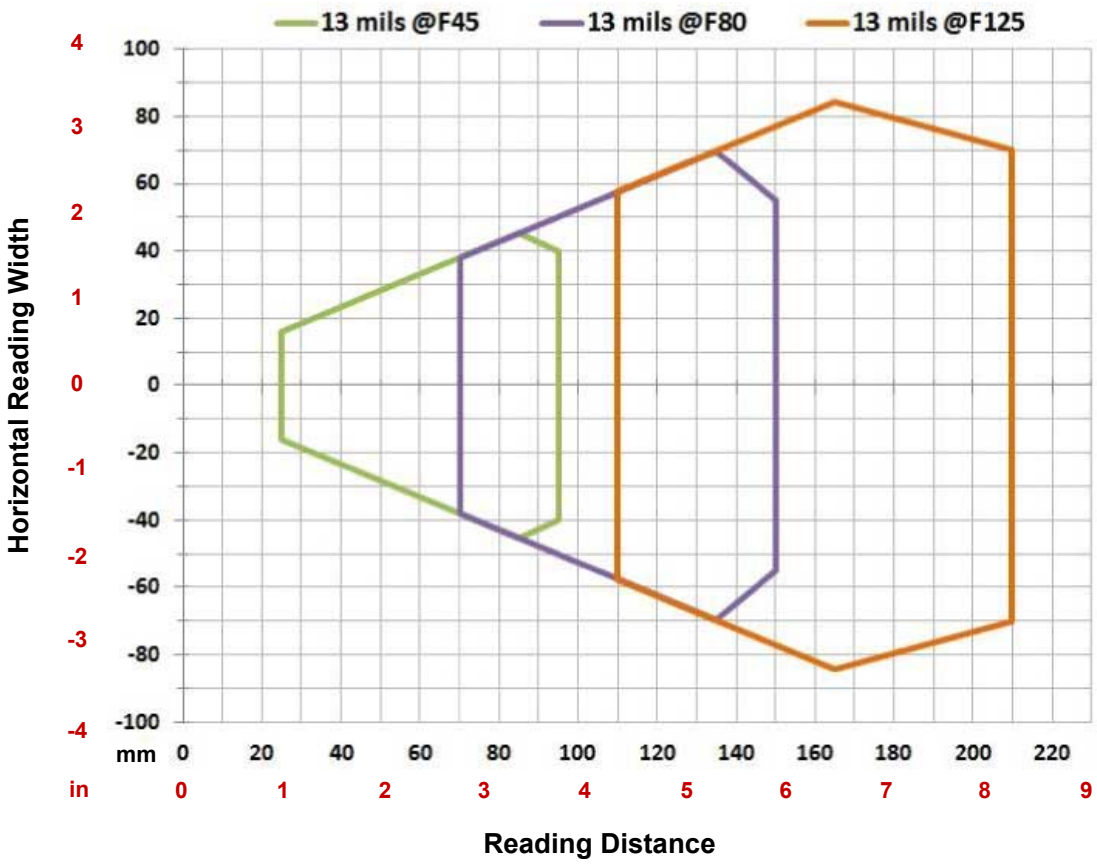


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.25 mm (10 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	80	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	400	600	700
Gain	10	20	25

Code 128 0.33 mm (13 mils)

Figure 176. Code 128 0.33 mm (13 mils)



Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.33 mm (13 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	80	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	400	600	700
Gain	10	20	25

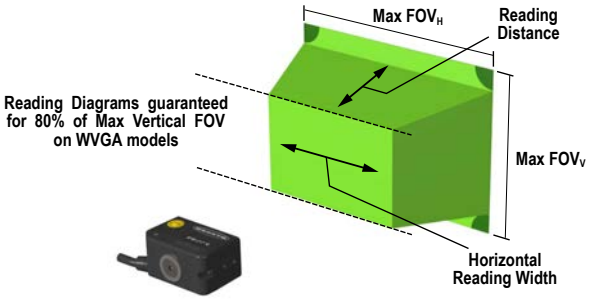
9.3.4 ABR3106-WSxx 1.2 MP Models 2D Codes

Vignetting

For ABR 3000 models used in 2D code reading applications, due to the "fisheye" or “vignetting” effect of the lens, the reading area is limited to the central zone of the Vertical FOV.

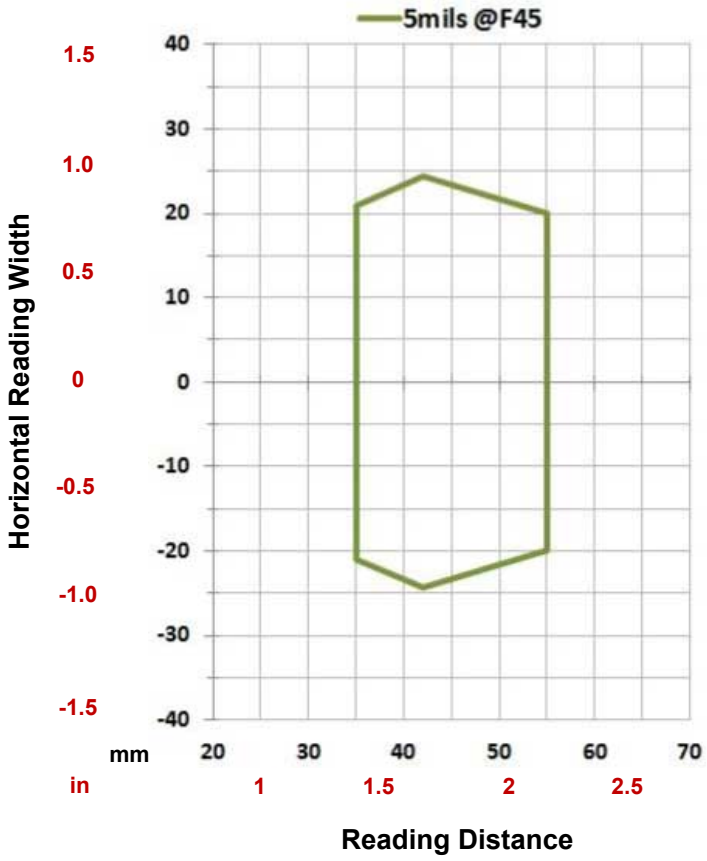
Depending on the application, Image Cropping can be applied above and below the central zone of the Vertical FOV, limiting image acquisition to the effective reading area and therefore increasing frame rate and reducing overall image processing time.

Figure 177. 1.2 MP Model Vignetting Effect



Data Matrix 0.13 mm (5 mils)

Figure 178. Data Matrix 0.13 mm (5 mils)



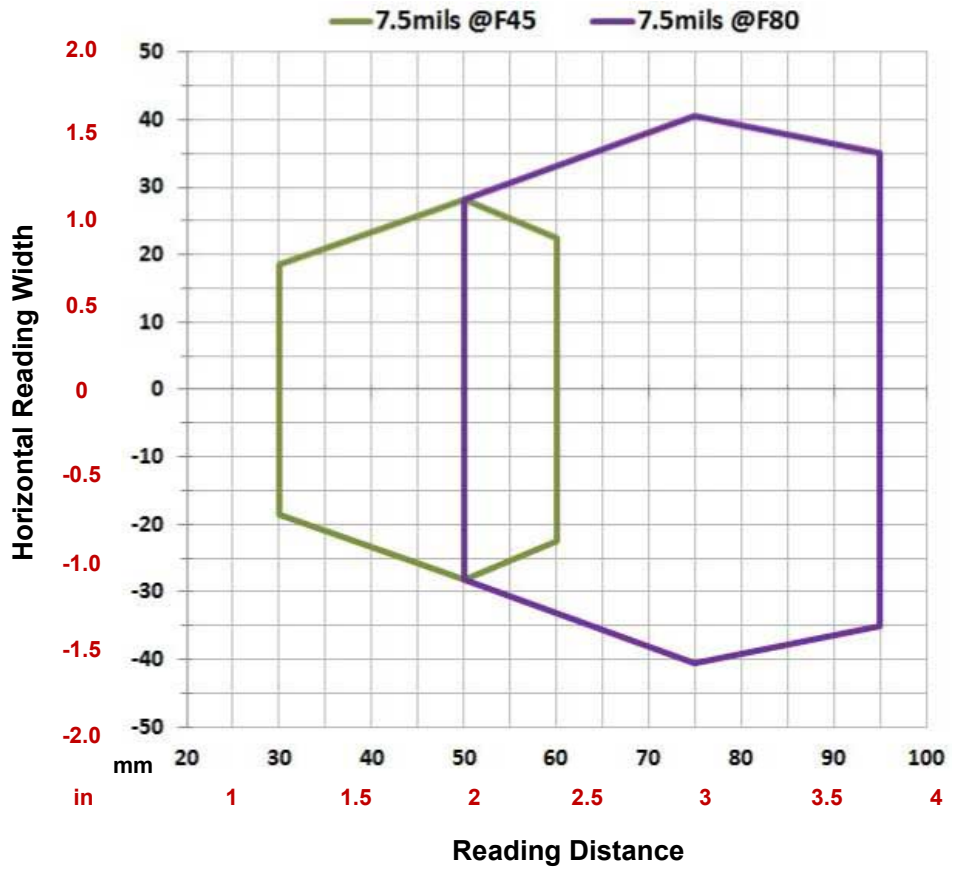
Hardware Settings	
Code Symbology	Data Matrix ECC 200
Code Resolution	0.12 mm (5 mils)
Tilt Angle	0°

Hardware Settings			
Skew Angle	15°		
Focusing Distance (mm)	45		

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	250		
Gain	10		

Data Matrix 0.19 mm (7.5 mils)

Figure 179. Data Matrix 0.19 mm (7.5 mils)



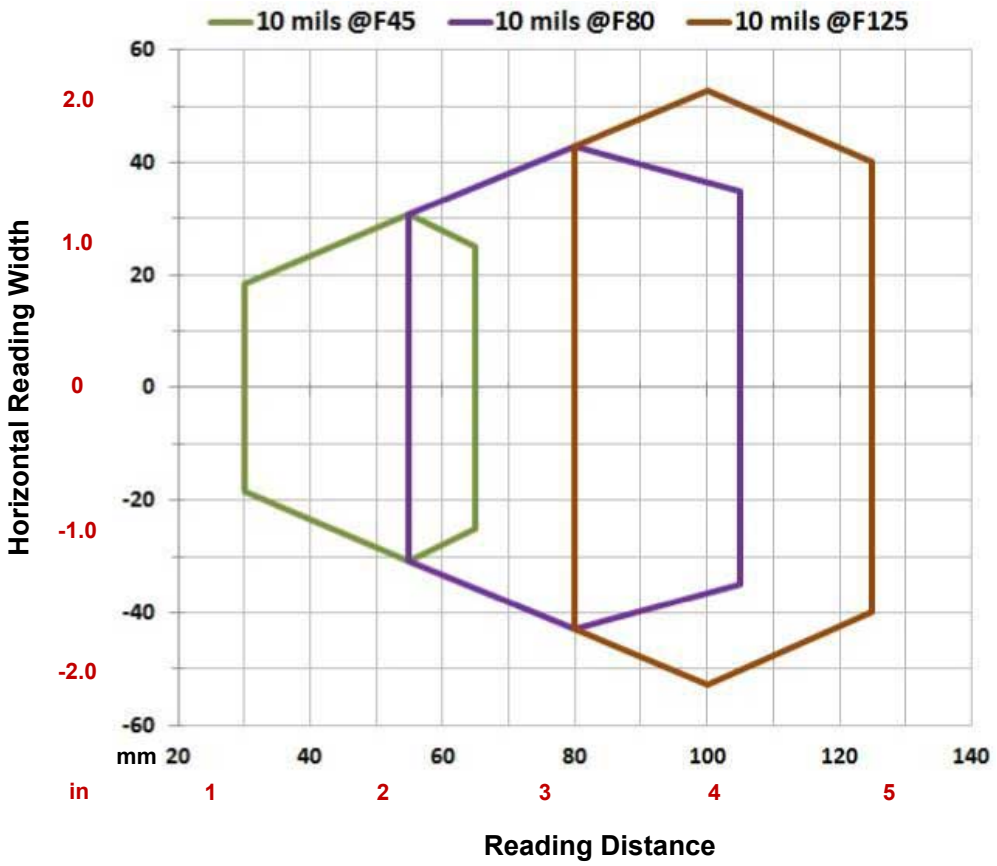
Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.19 mm (7.5 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	80	

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	200	400	

Software Parameters			
Gain	10	12	

Data Matrix 0.25 mm (10 mils)

Figure 180. Data Matrix 0.25 mm (10 mils)



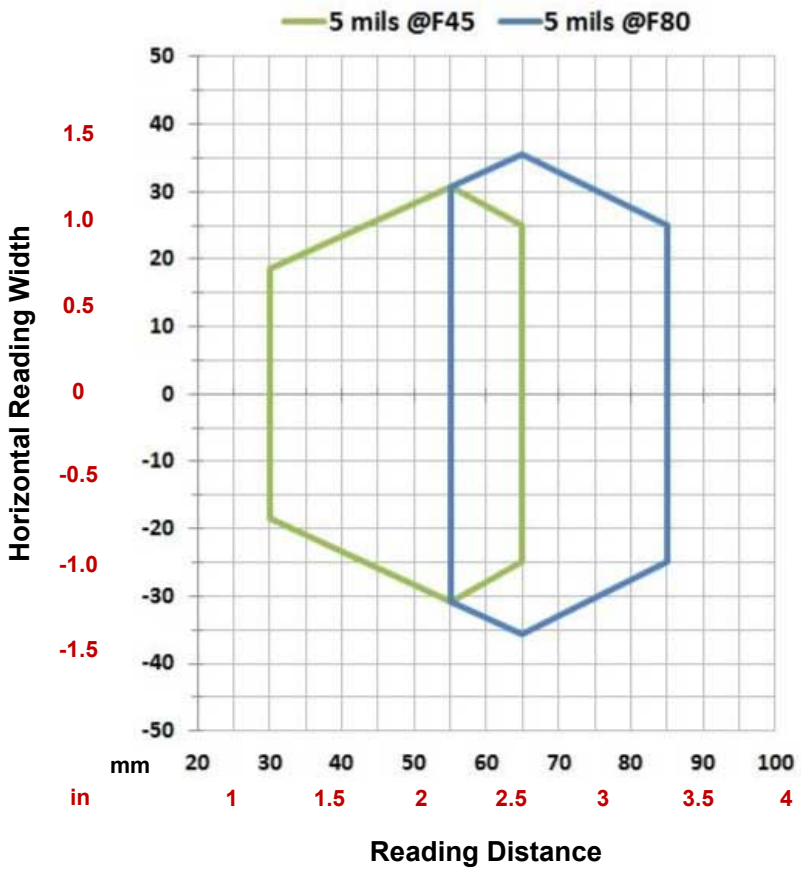
Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.25 mm (10 mils)		
Tilt Angle	0°		
Skew Angle	15°		
Focusing Distance (mm)	45	80	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	250	450	600
Gain	10	15	20

9.3.5 ABR3106-WPxx 1.2 MP + Polarized Models 1D Codes

Code 128 0.12 mm (5 mils)

Figure 181. Code 128 0.12 mm (5 mils)

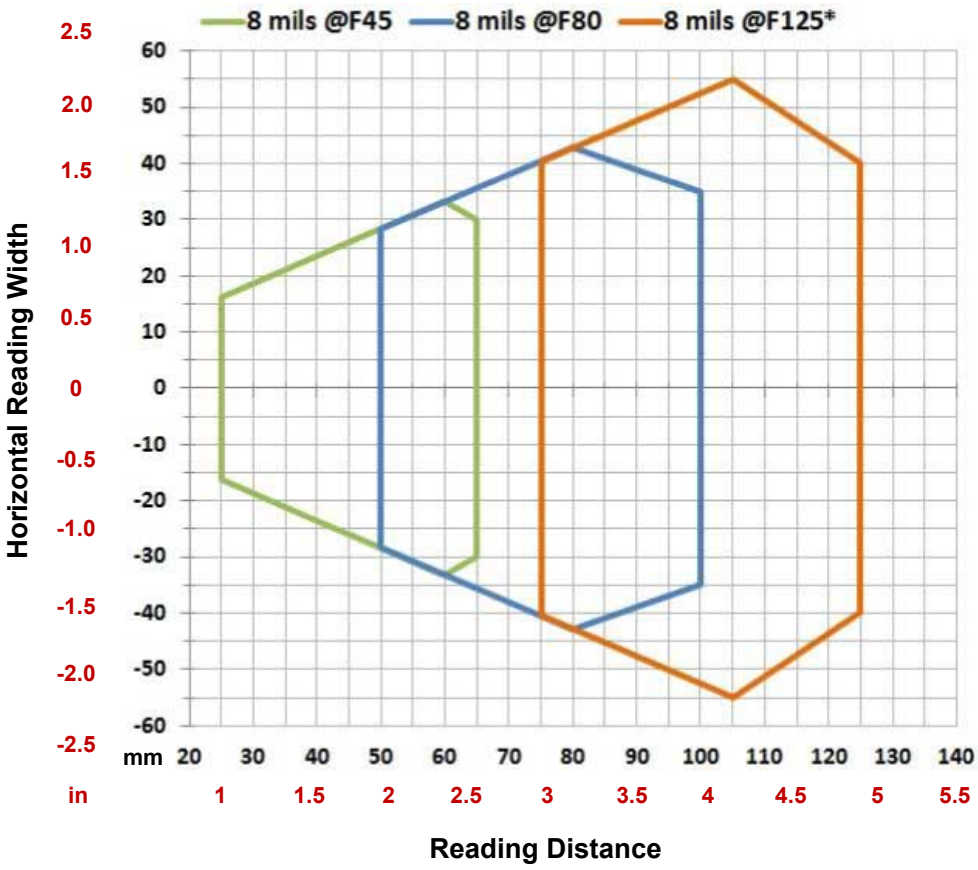


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.12 mm (5 mils)		
Tilt Angle	0°		
Skew Angle	0°		
Focusing Distance (mm)	45	80	

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	600	800	
Gain	25	32	

Code 128 0.20 mm (8 mils)

Figure 182. Code 128 0.20 mm (8 mils)

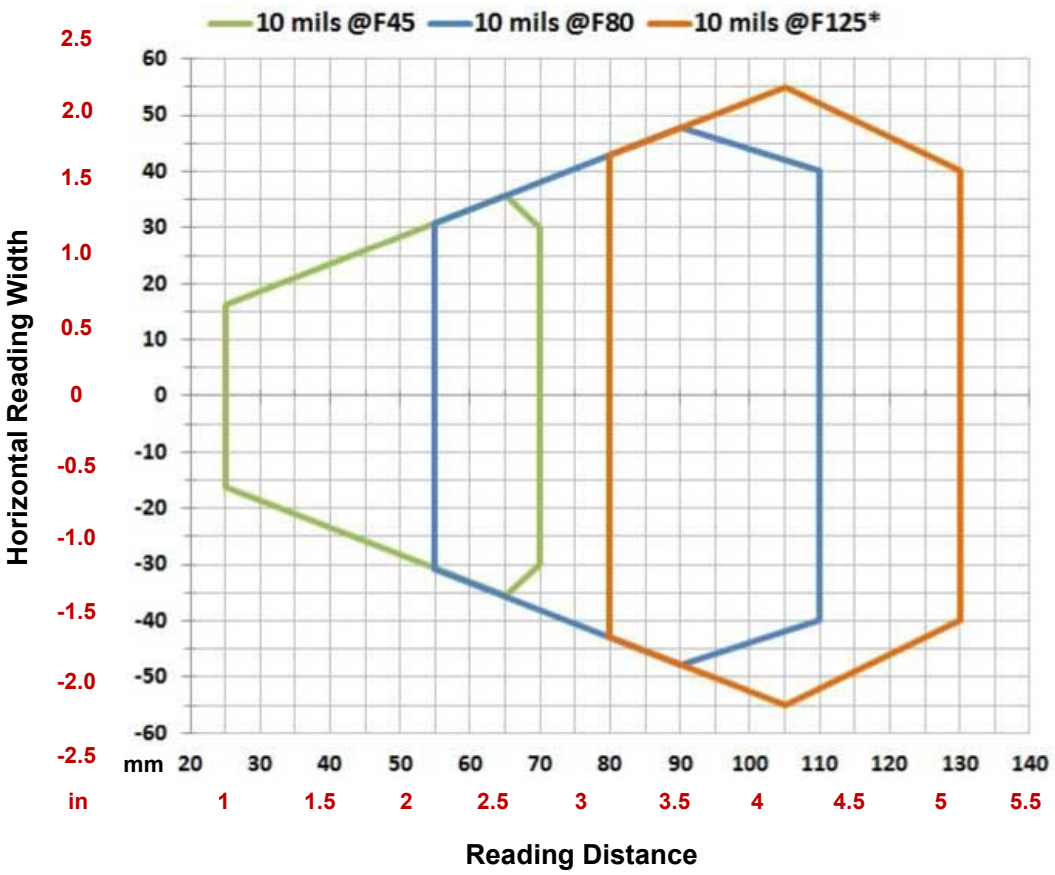


Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.20 mm (8 mils)		
Tilt Angle	0°		
Skew Angle	0°		
Focusing Distance (mm)	45	80	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	700	1000	1000
Gain	25	32	32

Code 128 0.25 mm (10 mils)

Figure 183. Code 128 0.25 mm (10 mils)



* The vignetting effect described in Vignetting on p. 118 applies to the F125 position for WA models.

Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.25 mm (10 mils)		
Tilt Angle	0°		
Skew Angle	0°		
Focusing Distance (mm)	45	80	125

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	700	1000	1000
Gain	25	32	32

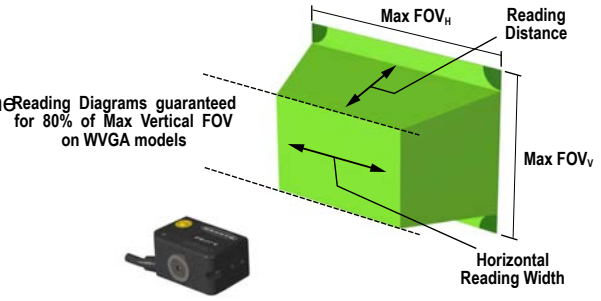
9.3.6 ABR3106-WPxx 1.2 MP + Polarized Models 2D Codes

Vignetting

For ABR 3000 models used in 2D code reading applications, due to the "fisheye" or “vignetting” effect of the lens, the reading area is limited to the central zone of the Vertical FOV.

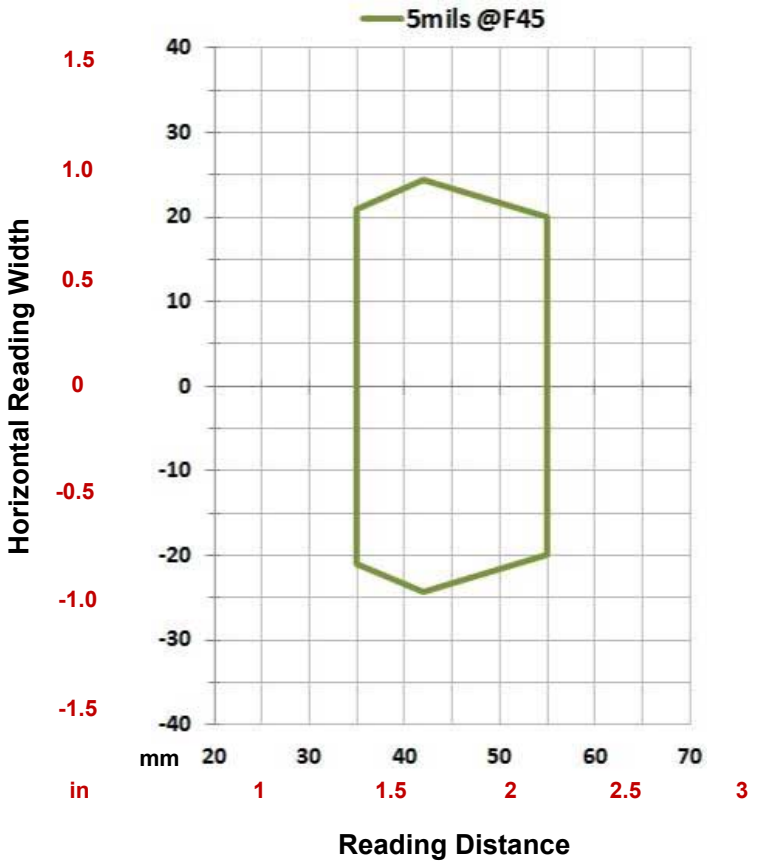
Depending on the application, Image Cropping can be applied above and below the central zone of the Vertical FOV, limiting image acquisition to the effective reading area and therefore increasing frame rate and reducing overall image processing time.

Figure 184. 1.2 MP + Polarized Model Vignetting Effect



Data Matrix 0.13 mm (5 mils)

Figure 185. Data Matrix 0.13 mm (5 mils)



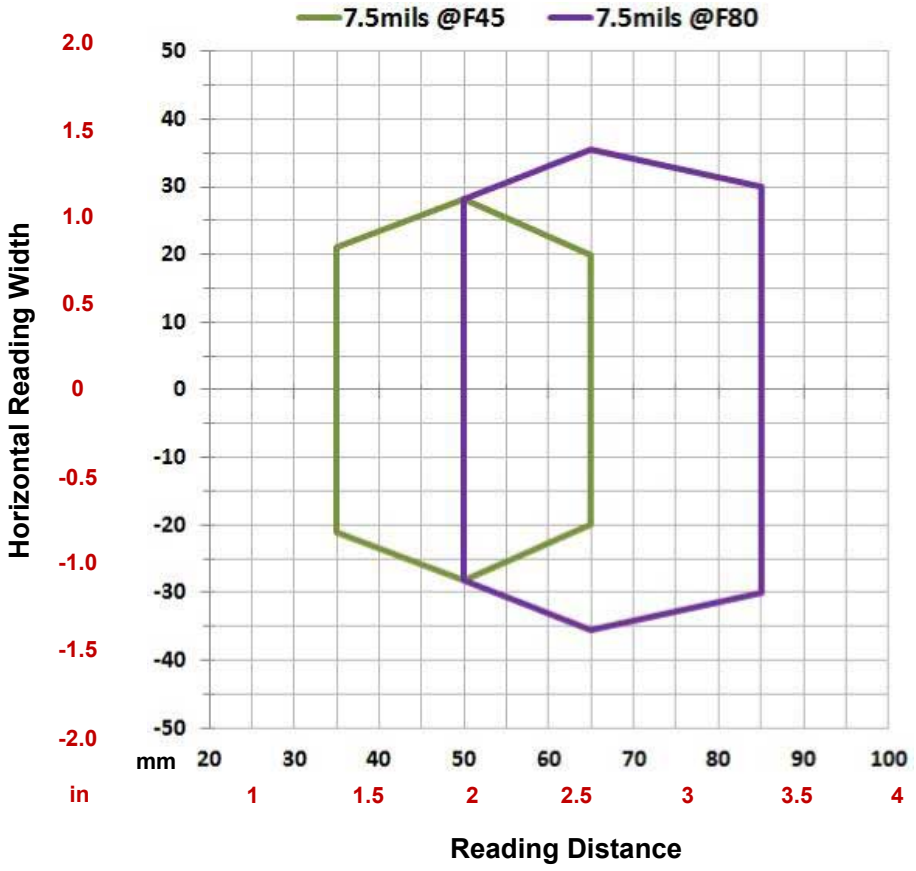
Hardware Settings	
Code Symbology	Data Matrix ECC 200
Code Resolution	0.13 mm (5 mils)
Tilt Angle	0°

Hardware Settings			
Skew Angle	0°		
Focusing Distance (mm)	45		

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	600		
Gain	24		

Data Matrix 0.19 mm (7.5 mils)

Figure 186. Data Matrix 0.19 mm (7.5 mils)



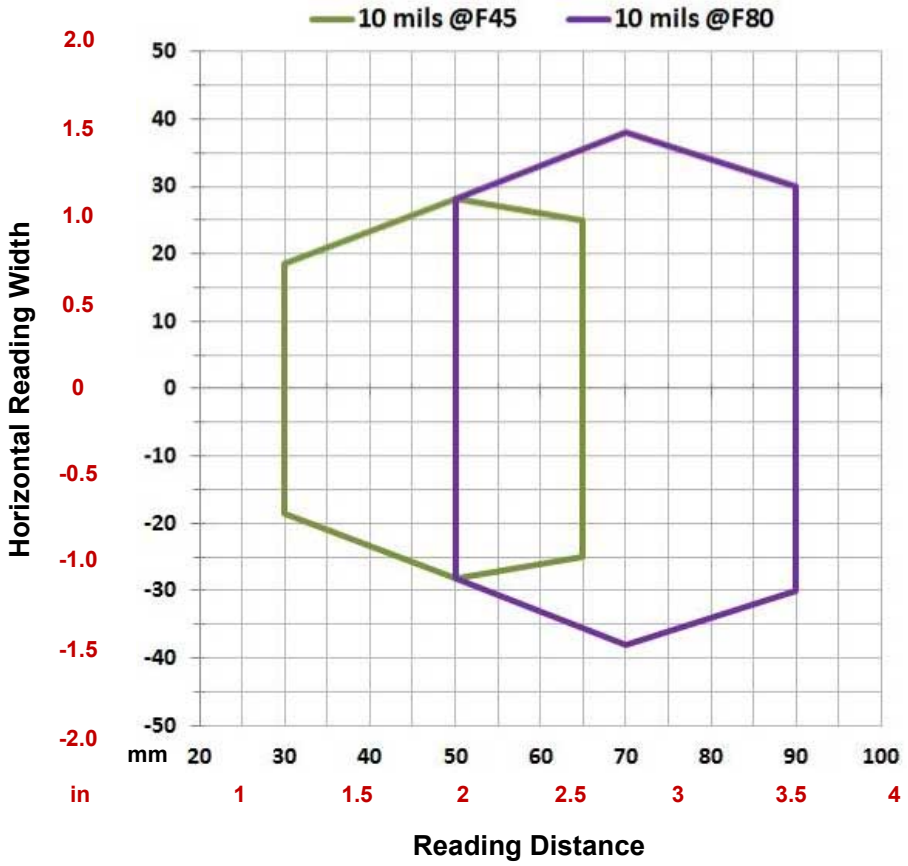
Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.19 mm (7.5 mils)		
Tilt Angle	0°		
Skew Angle	0°		
Focusing Distance (mm)	45	80	

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	600	900	

Software Parameters			
Gain	25	30	

Data Matrix 0.25 mm (10 mils)

Figure 187. Data Matrix 0.25 mm (10 mils)



Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.25 mm (10 mils)		
Tilt Angle	0°		
Skew Angle	0°		
Focusing Distance (mm)	45	80	

Software Parameters			
Illuminator Lighting	Very High Power Strobed		
Exposure Time (µs)	600	900	
Gain	25	30	

9.4 Maximum Line Speed and Exposure Calculations

When the **Dynamic** reading option is selected in the **Image Auto-Setup** or **Automatic Setup** window, the maximum allowable image exposure is automatically calculated according to the formula described in this section, using the parameters entered.

The Exposure Time (or Shutter) parameter defines the time during which the image will be exposed to the reader to be acquired. This parameter depends heavily on the environmental conditions (external lighting system, image contrast, etc.).

In general, a longer time corresponds to a lighter image but is susceptible to blurring due to the code movement; a shorter exposure time corresponds to a darker image.

Note: The following considerations might not apply for linear codes or postal code reading applications. The Maximum line speed allowed for linear codes or postal code reading applications heavily depends on the direction of symbol movement. When the direction of movement is parallel to the elements of the code, the maximum speed is greater.

Assuming:

- **X**: Code Resolution (mm)
- **T_{exp}**: Exposure Time (s)
- **LS**: Line Speed (mm/s)

Conversion to Metric

- [Code Resolution in mils] x 0.0254 = Code Resolution in mm
- n/a
- [Line Speed in ft/min] x 5.08 = Line Speed in mm/s

The essential condition to avoid blurring effects between two adjacent elements in a dynamic reading application is:

$LS \times T_{exp} \leq X$

The maximum (theoretical) line speed LS can be calculated as follows:

$X / T_{exp\ (min)} = LS_{(max)}$

$T_{exp\ (min)}$ is the minimum Exposure Time value obtainable for the specific application. It can be evaluated in static reading conditions and depends on the ABR model selected for the application (internal lighting system, optical lens, reading distance) and on any external lighting system. It may also depend on code printing quality, and reader position.

Examples

ABR 3000 using:

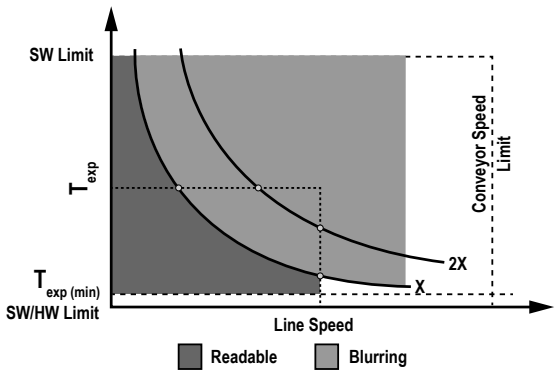
Internal Lighting Mode = Very High Power Strobe
Exposure Time (µs) = 200 µs
Code Resolution (X) = 0.254 mm (10 mils)

has a maximum line speed of: 0.254 (mm) / 0.0002 (s) = 1270 mm/s

Likewise, **$T_{exp\ (max)}$** is the maximum **Exposure Time** value that can be used without blurring for the given application line speed and code resolution. Therefore: $X / LS = T_{exp\ (max)}$

$T_{exp\ (max)}$ and **$LS_{(max)}$** are represented in the graph below as the curved line for **X** (code resolution). Values above the curve result in blurring. In practice, the application values are somewhere below the theoretical line, (in the dark gray area), due to environmental and other conditions.

Figure 188. Maximum Line Speed and Exposure



For example, the maximum target speed in the application is also affected by these conditions:

- **Code/Background Contrast**: Maximum speed decreases when decreasing image contrast (poor quality codes, reflective transparent coverings, different supports and printing techniques)
- **Code Resolution**: Maximum speed increases when decreasing code resolution, (that is, **2X**). There is a decrement of overlapping effects between two adjacent elements
- **Tilt Angle**: Maximum speed decreases when increasing Tilt angle (from 0 to 45 degrees)

The **Internal Lighting** parameter allows setting the operating mode of the internal lighting system. The possible values are:

- **Disabled**: The built-in LED array is turned off all the time. This option can be useful if using an external lighting system
- **Very High Power Strobed**: The built-in LED array is on only during the image exposure time

Note: To avoid the LED array overheating, for Power Strobed settings, the program automatically limits the range of allowed values for the Exposure Time parameter. Therefore, after changes to Internal Lighting, recheck Exposure Time.

10 PPI (Pixels Per Inch) Setup Chart

Print and use the Setup Chart on the following page to aid in aiming and focusing the reader (ABR 7000 liquid lens autofocus models), or in the Acquire PPI (Pixels Per Inch) procedure in the Advanced Setup of the reader (ABR3 000 and ABR 7000 manual focus models). Using this chart when running the AutoSetup procedure or the Focus Autolearn procedure on a liquid lens autofocus model typically results in a more accurate focus/reading distance. This in turn results in a better image and a more accurate PPI value. On any model, using this chart to accurately configure the PPI value allows the ABR to provide accurate module size measurements of barcodes for a given distance.

PPI (Pixels Per Inch) Setup Chart

Code 128

Resolution mm (mils)

0.30 (12)



0.30 mm

0.50 (20)

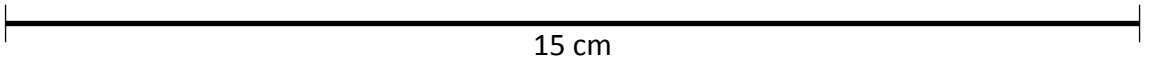


0.50 mm

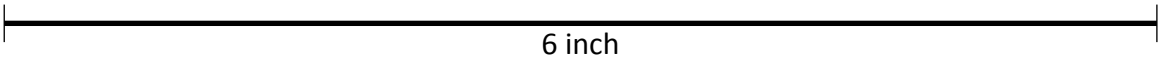
1.00 (40)



1 mm



15 cm



6 inch

Do not use these Barcodes for Smart Teach Autolearn

Do not scale this page

11 Application Examples

11.1 Document Handling

ABR is effective when used in the omnidirectional reading of 2D, stacked, linear, and postal codes. For example, in automated document handling and mail processing systems.

Figure 189. Address Coded in Data Matrix Symbology for Automated Mail Processing



11.2 Deformed or Overprinted Code Reading

ABR assures the reading of deformed and / or overprinted codes, even though damaged or printed on high reflective surfaces (see the following figures).

Figure 190. Packaging with PDF417 Code



Figure 191. Overprinted Barcode Readable by ABR Through the Envelope Window Film

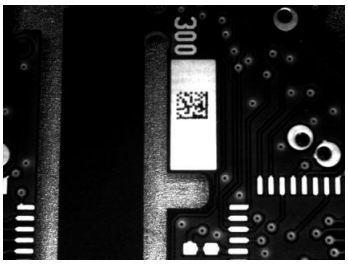


Figure 192. Barcode Printed on Curved Surface Readable by ABR in spite of Image Optical Distortion



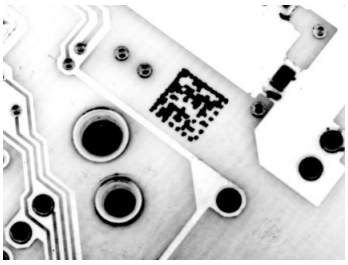
11.3 Ink-Jet Printing Technology

Figure 193. Dot Matrix Code Directly Marked on PCB Copper Pad by Using Ink-Jet Technology



11.4 Laser Marking/Etching Technology

Figure 194. Data Matrix Code Directly Marked on PCB Surface by Using Laser Etching Technology



CAUTION: ABR readers are not designed to be used in real-time laser marking applications (Mark & Read). They must be mounted far away from the laser marker to avoid burning the CMOS sensor.

11.5 Short Distance Code Reading on Reflective and/or Colored Surfaces

ABR 3000 1.2 MP Polarizer models provide advantages in particular applications which require codes to be read at very short reading distances on reflective and/or colored surfaces such as black plastic and have 0° skew angles.

Figure 195. 1.2 MP Polarizer Model Reading Reflective Label



Figure 196. Standard Model Reading Reflective Label



12 Troubleshooting

- When wiring the device, pay careful attention to the signal name (acronym) on the TCNM-ACBB1 spring clamp connectors (TCNM-ACBB1 Electrical Connections on p. 19). If you are connecting directly to the ABR M12 17-pin connector pay attention to the pin number of the signals (Connector Descriptions on p. 14).
- If you need information about a certain reader parameter, refer to the Barcode Manager online help. Connect the device and click on the link to the parameter you're interested in.
- If you're unable to fix the problem and you're going to contact Banner Engineering, provide (if possible): Application Program version, Parameter Configuration file, serial number and model number of your reader. Most of this information is available while Barcode Manager is connected to the reader.

Problem	Solution
Barcode Manager Installation: Autorun or Start.hta doesn't run	• Check the Windows settings to see if Autorun is disabled • Associate the file type .hta with the Microsoft HTML Application host mshta.exe in Windows\System32
Driver Installation Error: The ECM driver fails to install correctly (ABR 3000 models)	Windows 7 requires that update KB3033929 be installed for the ABR 3000 ECM driver to work properly.
Power ON: The **POWER** LED is not lit	• Is power connected? • If using a power adapter (like PG6000), is it connected to a wall outlet? • If using rail power, does the rail have power? • If using TCNM-ACBB1, does it have power (check switch and LED)? • Check if you are referring to the M12 17-pin connector or to the TCNM-ACBB1 spring clamp connectors. • Measure Voltage either at pin 1 and pin 2 (for 17-pin connector) or at spring clamp Vdc and GND (for TCNM-ACBB1).
One Shot or Phase Mode using the Input 1 (External Trigger) or Input 2: The **Trigger** LED is not blinking while the External Trigger is switching	• Check if you are referring to the device/accessory cable connector or to the TCNM-ACBB1 spring clamp connectors • Is the sensor connected to the Input 1 or Input 2? • Is power supplied to the photoelectric sensor? • For NPN configuration, is power supplied to one of the two I1 or I2 signals (A or B)? • For PNP configuration, is one of the two I1 or I2 signals grounded (A or B)? • Are the photoelectric sensor LEDs (if any) working correctly? • Is the sensor/reflector system aligned (if present)? • On the Reading Phase step check the Input 1 or Input 2 Debouncing Time parameter setting • On the Reading Phase step check the settings for Acquisition Trigger, Reading Phase-ON, and Reading Phase-OFF parameters
One Shot or Phase Mode using serial trigger source: The **Trigger** LED is not blinking	• On the Reading Phase step check the settings for Acquisition Trigger, Reading Phase-ON, and Reading Phase-OFF parameters • Are the COM port parameters (Baud Rate, Parity, Data Bits, Stop Bits) correctly assigned? • On the Reading Phase step check the settings of Acquisition Trigger String, Reading Phase-ON String, and Reading Phase-OFF String parameters • Is the serial trigger source correctly connected?
Phase Mode: the **Trigger** LED is correctly blinking but no image is displayed in the Barcode Manager window	Is the Phase frequency lower than the maximum frame rate?
Continuous Mode: the **Trigger** LED is not blinking	Verify the correct software configuration settings

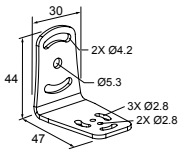
Problem	Solution
Any Operating Mode: the **Trigger** LED is correctly blinking but no result is transmitted by the reader at the end of the reading phase collection	Check the Code Collection parameters on the Reading Phase step and the Communications parameters on the Communications step.
Image not clear	• Verify the Focus procedure • Verify the reading distance
Image focused but not decoded	Verify the Calibrate Image Density procedure
Reading: The reader always transmits the *No Read Message*	• See Getting Started on p. 30 • Position the reader as described in Position the Reader on p. 10 and through Barcode Manager: ◦ Tune the Acquisition Delay on Trigger, if the moving code is out of the reader field of view ◦ Set the Continuous Operating Mode if no external source is available ◦ Tune the Image Settings to improve the code image quality ◦ Check the parameter settings in the Advanced Setup step: 2D Codes, 1D Codes, and Postal Codes ◦ View the full resolution code image to check the printing or marking quality
Communication: Reader is not transmitting anything to the host	• Is the serial cable wiring correct? • If using TCNM-ACBB1, be sure the RS422 termination switch is OFF • Are the host serial port settings the same as the reader serial port settings? • In Barcode Manager **Device menu** > **Settings** > **Settings** > **LED Configuration**, the COM LED Function can be configured to indicate Main Serial Port TX or Main Serial Port RX
Communication: Data transferred to the host are incorrect, corrupted or incomplete	• Are the host serial port settings the same as the reader serial port settings? • In the Barcode Manager Communications step, check the settings of Header and Terminator String parameters • In the Barcode Manager Communications step, check the various Message Field parameter settings
Configuration: Cannot access environment parameters in Barcode Manager (**Device** > **Settings** > **Settings** menu item is gray)	Are you using the **Installer - Expert User** level? If not change it in the **Options** > **Change User** menu.
How do I find my reader serial number?	• The reader serial number consists of 9 characters: one letter, 2 numbers, another letter followed by 5 numbers • The reader serial number is printed on a label that is affixed on the bottom case near the reading window • The serial number is also visible from the Barcode Manager **Device List** Area

13 Accessories

13.1 Brackets

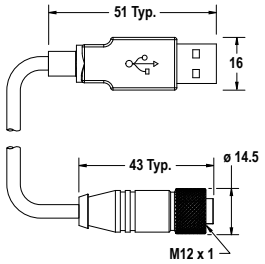
SMBABR3RA

- Replacement right-angle bracket for ABR 3000 models
- Included with the product
- 14 gauge cold rolled steel

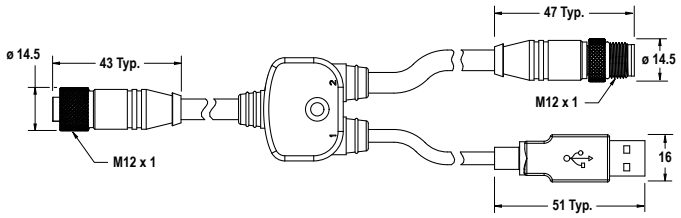


13.2 Cordsets

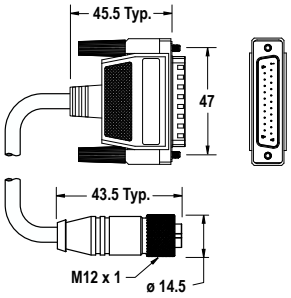
The MQDEC-1703SS-USB is for use with USB models that do not use I/O or serial communication. See Figure 15 on p. 14.

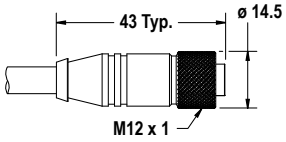
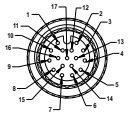
17-pin M12/Euro-style Female to USB Shielded Cable			
Model	**Length**	**Style**	**Dimensions**
MQDEC-1703SS-USB	0.91 m (3 ft)	Straight	

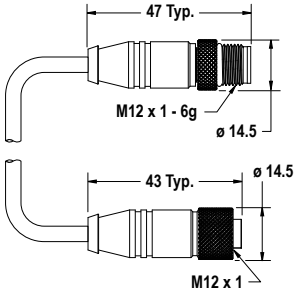
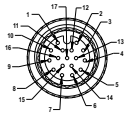
The CSB-M121701USB02M121702 is for use with USB models using I/O and serial communication. See Figure 13 on p. 13.

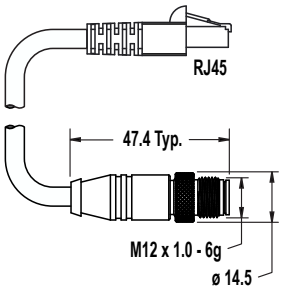
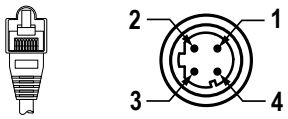
Euro-Style and USB Splitter Cable		
Model	**Branches**	**Trunk**
CSB-M121701USB02M121702	Branch 1: USB, 0.6 m (2 ft) Branch 2: 17-pin M12 Male, 0.6 m (2 ft)	17-pin M12 Female, Straight, 0.3m (1 ft)
		

The MQDEC-1703SS-DB25 is required for use with the TCNM-ACBB1. See Figure 11 on p. 12.

17-pin M12/Euro-style Female to DB25 Male Shielded			
Model	**Length**	**Style**	**Dimensions**
MQDEC-1703SS-DB25	0.91 m (3 ft)	Straight	

17-pin M12/Euro-style Female Shielded Quick Disconnect				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDC2S-1706	1.83 m (6 ft)	Straight		 1 = Brown 2 = Blue 3 = White 4 = Green 5 = Pink 6 = Yellow 7 = Black 8 = Gray 9 = Red 10 = Violet 11 = Gray/Pink 12 =Red/Blue 13 = White/ Green 14 = Brown/ Green 15 = White/ Yellow 16 = Yellow/ Brown 17 = White/ Gray
MQDC2S-1715	4.57 m (15 ft)			
MQDC2S-1730	9.14 m (30 ft)			

17-pin M12/Euro-style Extension Shielded Cable				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDEC-1706SS	1.83 m (6 ft)	Straight		 1 = Brown 2 = Blue 3 = White 4 = Green 5 = Pink 6 = Yellow 7 = Black 8 = Gray 9 = Red 10 = Violet 11 = Gray/Pink 12 =Red/Blue 13 = White/ Green 14 = Brown/ Green 15 = White/ Yellow 16 = Yellow/ Brown 17 = White/ Gray
MQDEC-1715SS	4.57 m (15 ft)			
MQDEC-1730SS	9.14 m (30 ft)			

4-pin M12/Euro-style D-code to RJ45 Shielded Ethernet				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Male)**
STP-M12D-406	1.83 m (6 ft)	Straight		 1 = White/ Orange 2 = Orange 3 = White/ Blue 6 = Blue 1 = White/ Orange 2 = White/ Blue 3 = Orange 4 = Blue
STP-M12D-415	4.57 m (15 ft)			
STP-M12D-430	9.14 m (30 ft)			

13.3 Trigger Kit

Kit QS18LPTRIGKIT01 includes:

Qty.	Model	Description
1	QS18VP6LPQ5	QS18 polarized retroreflective sensor, 150 mm (6 in) PVC cable with a 4-pin M12/Euro-style quick disconnect, and nickel-plated brass coupling nut. Range: 3.5 m (12 ft)
1	MQDC-415	4.57 m (15 ft) cable with a 4-pin threaded M12/Euro-style straight connector
1	BRT-60X40C	Rectangular 60×40 mm retroreflective target. Reflectivity factor: 1.4
1	SMB18UR	Two-part universal rotating stainless steel bracket

13.4 Connection Boxes and Power Supply Boxes

TCNM-ACBB1

- Connection box
- For ABR 3000 and 7000 models



PSB4MK-24-06-Q0Q5

- Power supply box
- 0.6 A 24 V dc
- Requires AC cable SM30CC-306-WP
- Requires DC cable MQDMC-401



14 Product Support and Maintenance

14.1 Repairs

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

Important: If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

14.2 Maintenance

Maintenance tasks include keeping the hardware free of dust and dirt and updating the Barcode Manager software and sensor firmware as new versions become available.

14.2.1 Clean the Reader

Dust, dirt, etc. on the lens cover may alter the reading performance.

Clean the lens cover periodically for continued correct operation of the reader.

Use soft material and alcohol to clean the lens cover and avoid any abrasive substances.

Repeat the operation frequently in particularly dirty environments.

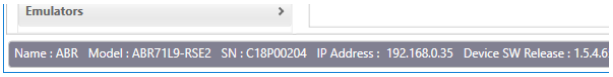
14.2.2 Update the Software and Firmware

The current version of Barcode Manager software and the device firmware is available for download from www.bannerengineering.com.

14.2.3 Update the Firmware

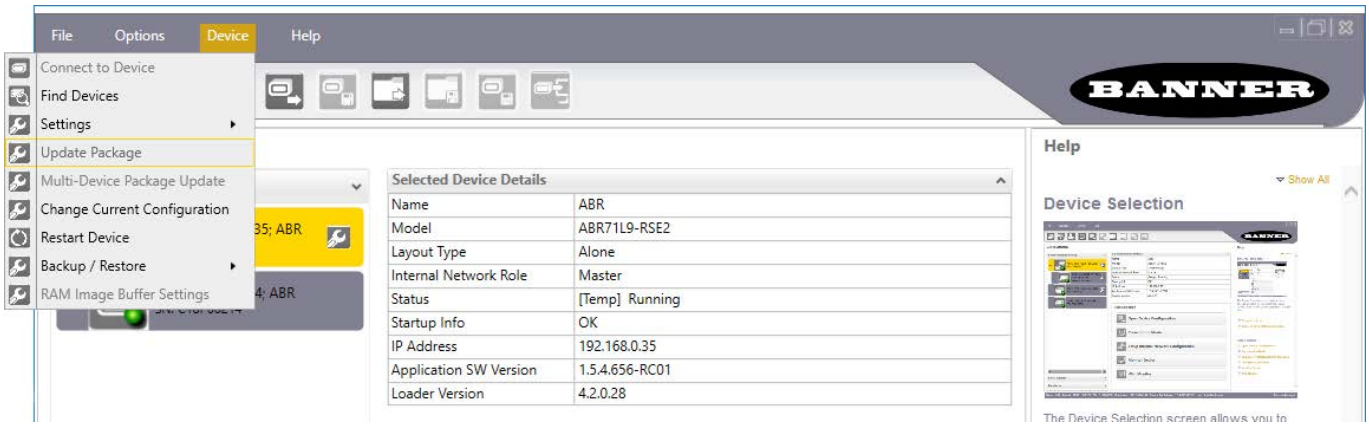
1. Make sure the device to be updated is selected and is shown in the status bar.

Figure 197. Status Bar



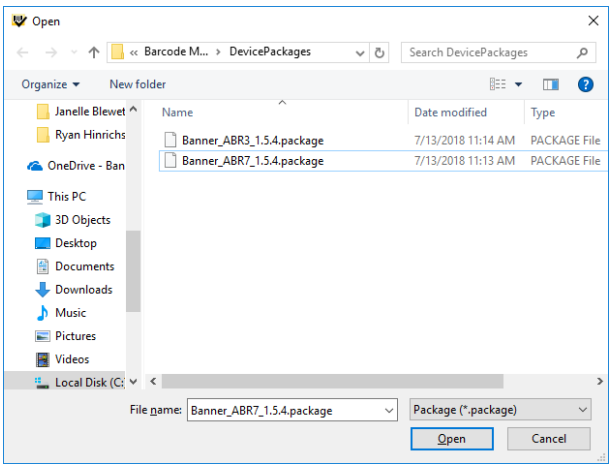
2. Go to **Device** > **Update Package**.

*Figure 198. **Update Package***



3. Select the firmware package file for your device family.

Figure 199. Select the Firmware File



The **Device Package Update** window displays.

4. Click **Yes** to start the update.
   The **Device Restart Information** window displays.
5. Click **OK** to restart the device.
   The update finishes, the reader restarts, and Barcode Manager returns to the **Home/Device Selection** page.
6. If the reader is not listed in the **Device List Area**, click **Find Devices** to search for the reader.

14.3 Reset the Reader to the Factory Default Environment (Optional)

If it becomes necessary to reset the reader's environment parameters to the factory default values, use the Smart Teach button to perform the following procedure.

1. While powering up the reader, press and hold the Smart Teach button until all five Smart Teach LEDs flash simultaneously.
2. Release and immediately re-press the Smart Teach button one time.
   The reader beeps once as all 5 LEDs flash on simultaneously once more, and then turn off. After a few seconds the ABR enters run mode, and the internal illuminators start flashing. All of the reader's environment parameters are reset, including the IP address for Ethernet models (defaults to 192.168.3.100). Any previously saved configurations on the reader remain in memory, but the default configuration is set as the startup configuration.

Note: If you press and hold the Smart Teach button from power up until the point when the Smart Teach LEDs flash on and off for about 3 seconds, but you do not release within the 3 seconds or you release and re-press the button too slowly, the reader enters a manufacturer's software loading mode instead. The internal illuminators remain off as the Smart Teach LEDs cycle through various blinking patterns. Cycle power to return to Run mode or try again.

14.4 Contact Us

Banner Engineering Corp. headquarters is located at:

9714 Tenth Avenue North
Minneapolis, MN 55441, USA
Phone: + 1 888 373 6767

For worldwide locations and local representatives, visit www.bannerengineering.com.

14.5 Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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For patent information, see www.bannerengineering.com/patents.

15 Glossary

A

AIM

(Association for Automatic Identification and Mobility): AIM Global is the international trade association representing automatic identification and mobility technology solution providers.

AIM DPM Quality Guideline

Standard applicable to the symbol quality assessment of direct part marking (DPM) performed in using two-dimensional barcode symbols. It defines modifications to the measurement and grading of several symbol quality parameters.

B

Barcodes (1D Codes)

A pattern of variable-width bars and spaces which represents numeric or alphanumeric data in machine-readable form. The general format of a barcode symbol consists of a leading margin, start character, data or message character, check character (if any), stop character, and trailing margin. Within this framework, each recognizable symbology uses its own unique format.

BIOS

Basic Input Output System. A collection of ROM-based code with a standard API used to interface with standard PC hardware.

Bit

Binary digit. One bit is the basic unit of binary information. Generally, eight consecutive bits compose one byte of data. The pattern of 0 and 1 values within the byte determines its meaning.

Bits per Second (bps)

Number of bits transmitted or received per second.

Bright Field Illumination

Lighting of surfaces at high (narrow) angles used to provide maximum reflection of the light to the reader's lens. This is effective on surfaces that absorb light or are not highly reflective and also on low contrast codes.

Byte

On an addressable boundary, eight adjacent binary digits (0 and 1) combined in a pattern to represent a specific character or numeric value. Bits are numbered from the right, 0 through 7, with bit 0 the low-order bit. One byte in memory can be used to store one ASCII character.

C

Composite Symbologies

Consist of a linear component, which encodes the item's primary data, and an adjacent 2D composite component, which encodes supplementary data to the linear component.

D

Dark Field Illumination

Lighting of surfaces at wide angles used to avoid direct reflection of the light into the reader's lens. Typically this type of lighting is used in DPM solutions to enhance reflectance of the uneven surface do to the symbol marking technique. It is also used with very reflective surfaces.

Decode

To recognize a barcode symbology (for example, Codabar, Code 128, Code 3 of 9, UPC/EAN, etc.) and analyze the content of the barcode scanned.

Depth of Field

The difference between the minimum and the maximum distance of the object in the field of view that appears to be in focus.

Diffused Illumination

Distributed soft lighting from a wide variety of angles used to eliminate shadows and direct reflection effects from highly reflective surfaces.

Direct Part Mark (DPM)

A symbol marked on an object using specific techniques like dot peening, laser etching, chemical etching, etc.

E

EEPROM

Electrically Erasable Programmable Read-Only Memory. An on-board non-volatile memory chip.

Element

The basic unit of data encoding in a 1D or 2D symbol. A single bar, space, cell, dot.

Exposure Time

For digital cameras based on image sensors equipped with an electronic shutter, it defines the time during which the image will be exposed to the sensor to be acquired.

F

Flash

Non-volatile memory for storing application and configuration files.

H

Host

A computer that serves other terminals in a network, providing services such as network control, database access, special programs, supervisory programs, or programming languages.

I

Image Processing

Any form of information processing for which the input is an image and the output is, for instance, a set of features of the image.

Image Resolution

The number of rows and columns of pixels in an image. The total number of pixels of an image sensor.

Image Sensor

Device converting a visual image to an electric signal. It is usually an array of CCD (Charge Coupled Devices) or CMOS (Complementary Metal Oxide Semiconductor) pixel sensors.

IEC

(International Electrotechnical Commission): Global organization that publishes international standards for electrical, electronic, and other technologies.

IP Address

The terminal's network address. Networks use IP addresses to determine where to send data that is being transmitted over a network. An IP address is a 32-bit number referred to as a series of 8-bit numbers in decimal dot notation (for example, 130.24.34.03). The highest 8-bit number you can use is 254.

ISO

(International Organization for Standardization): A network of the national standards institutes of several countries producing world-wide industrial and commercial standards.

L

LED (Light Emitting Diode)

A low power electronic light source commonly used as an indicator light. It uses less power than an incandescent light bulb but more than a Liquid Crystal Display (LCD).

LED Illuminator

LED technology used as an extended lighting source in which extra optics added to the chip allow it to emit a complex radiated light pattern.

M

Matrix Symbologies (2D Codes)

An arrangement of regular polygon shaped cells where the center-to-center distance of adjacent elements is uniform. Matrix symbols may include recognition patterns which do not follow the same rules as the other elements within the symbol.

Multi-row (or Stacked) Symbologies

Symbologies where a long symbol is broken into sections and stacked one upon another similar to sentences in a paragraph.

R

RAM

Random Access Memory. Data in RAM can be accessed in random order, and quickly written and read.

S

Symbol Verification

The act of processing a code to determine whether or not it meets specific requirements.

T

Transmission Control Protocol/Internet Protocol (TCP/IP)

A suite of standard network protocols that were originally used in UNIX environments but are now used in many others. The TCP governs sequenced data; the IP governs packet forwarding. TCP/IP is the primary protocol that defines the Internet.

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